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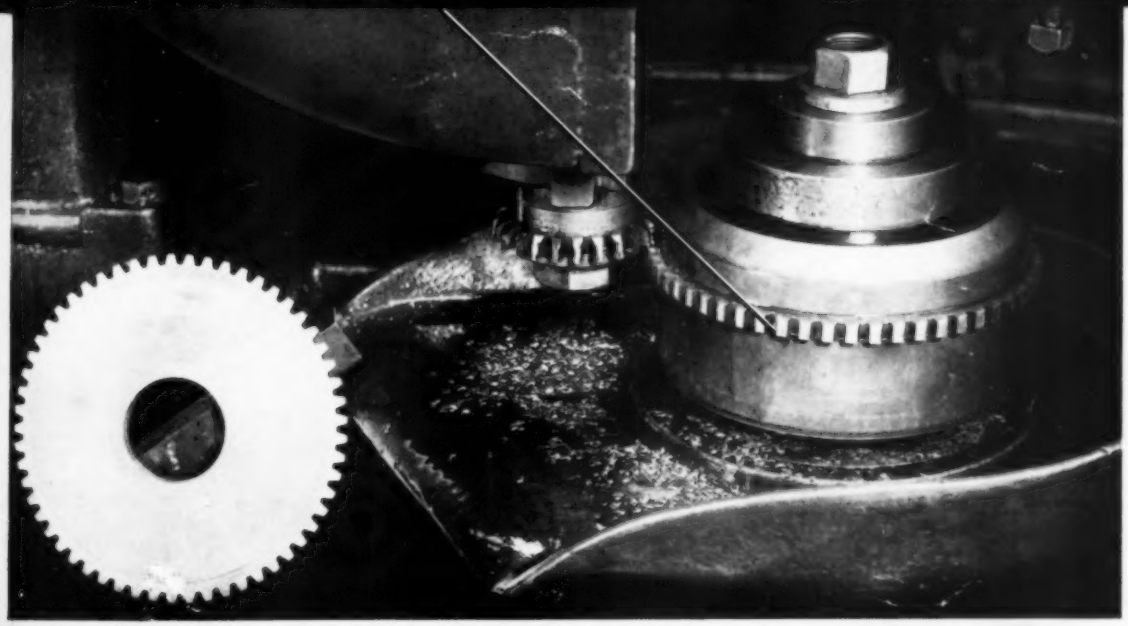

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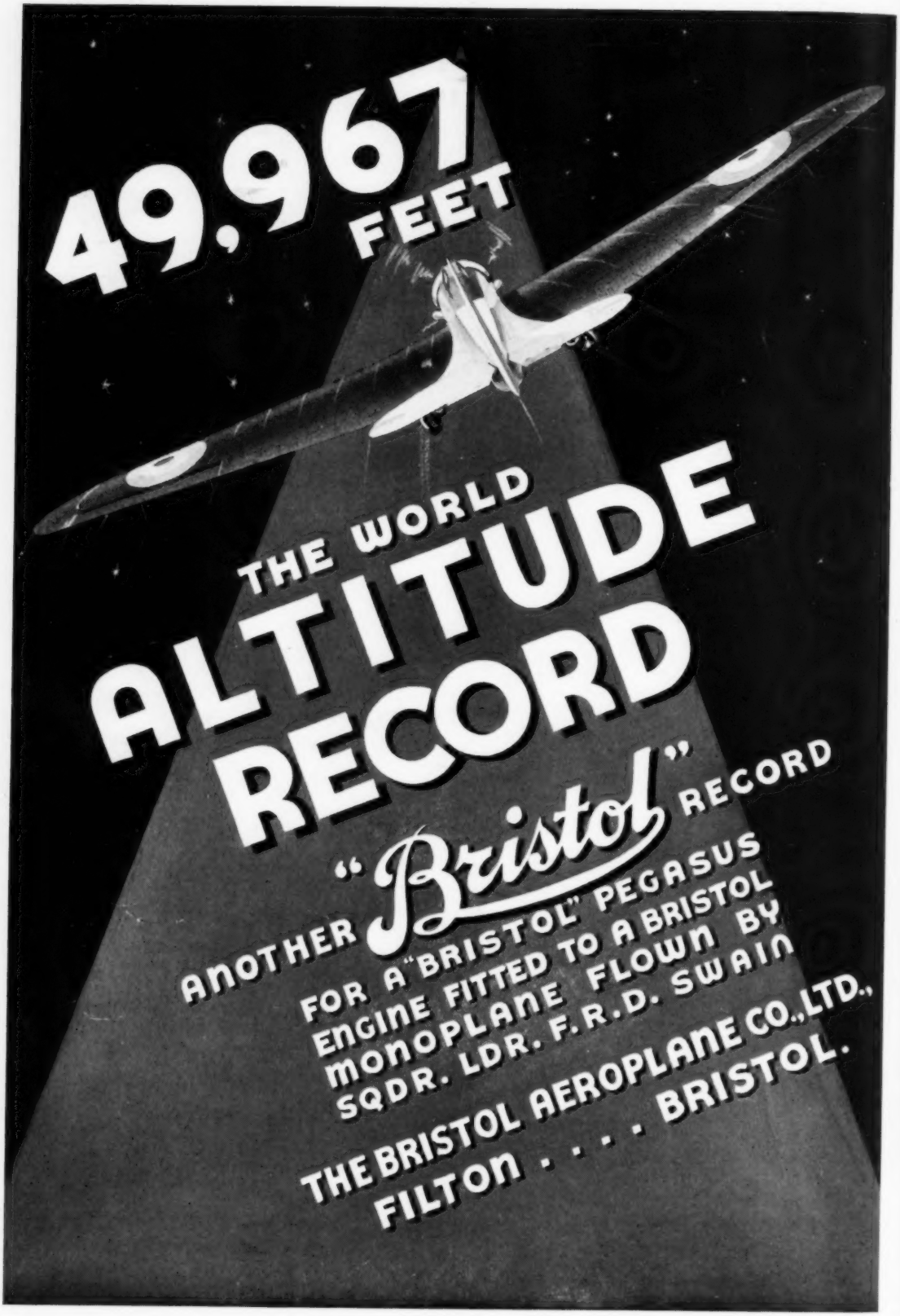
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FLIGHT
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FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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King George VI

THE first king who has ever qualified as an air pilot and won his "wings" as an officer of the Royal Air Force, or any other Air Force, has now ascended the British Throne. In unison with the whole British Empire, *Flight* respectfully offers its congratulations and declares its loyalty.

King George VI, first known as Prince Albert, was educated for the Royal Navy, in the *Britannia* and at Osborne and Dartmouth. The outbreak of the war found him a midshipman on the battleship H.M.S. *Collingwood*, and in one of her gun turrets he went through the battle of Jutland. He was "commended" in Lord Jellicoe's despatch for his coolness under fire. The last king of England who took part in a sea fight was William IV at Cape St. Vincent, and before him there was James II, a very gallant warrior though an unsuccessful king. To find another example we have to go back to Edward III, who commanded in a stubborn fleet action known as "Espagñols sur mer."

Illness cut short Prince Albert's naval career. Not long afterwards the Royal Air Force came into being, and it was obviously desirable that the infant Service should have a connection with the Royal Family. It seemed almost providential that Prince Albert was available. He was gazetted to the Force, trained at Cranwell, and was posted to the staff of Sir Hugh (now Lord) Trenchard, who then commanded the Independent Air Force in France. Though an officer who had gone through the thunders of Jutland would undoubtedly have cheerfully faced the dangers of a bombing raid over enemy territory, the risks of a forced landing and capture by the enemy were obviously too great for the G.O.C. to allow the King's son so to expose himself.

After the Armistice Prince Albert learnt to fly, and was given his "wings." The illustration on the next page shows him flying an Avro 504K. As Duke of York he has always maintained his close connection with the Royal Air Force, and on State occasions he has usually worn its uniform. Last year he and the Duchess of York flew to Brussels for the Exhibition, and so our new Queen Elizabeth is the first queen of England to have gone into the air.

Our airman King has come to the Throne at a time when the Royal Air Force is expanding to a size and importance not known since the War, and its prestige has never stood so high. It is certain that King George VI will give encouragement and inspiration to this great development. It will hearten every pupil at a flying school to remember that his King has had to grapple with the very problems which now confront himself.

Keeping Faith

WHEN air transport suffers a disaster such as that experienced by the Royal Dutch Air Lines last week, people—even those intimately concerned with and full of faith in the future of air travel—pass through a momentary period of doubt. They wonder whether the price is, after all, too high, and whether development should not mark time for a few years while the position is being consolidated. They wonder whether it is possible to say yet again that "this is the price of progress," without hearing a faint and unctuous echo; it has been said so often.

The price, of course, *is* high. Flying is the most comfortable, convenient and dangerous form of transport; fortunately, the comfort and convenience more than balance the danger.

If it were possible at this moment to ground every aeroplane in the world, those who had themselves suffered in the cause of progress would be the first to forbid such a retreat. Even to doubt is to break faith with the hundreds who have died since mankind first dreamt of the conquest of the air.

The Lesson

Until a thorough investigation has been made, it is not possible to express any opinion as to what may have happened, and, indeed, it is quite likely that the cause will never be established. What does appear to emerge from this sad accident is that an aerodrome which is the London terminus of a number of air lines owned by and operating from foreign countries should be so planned and situated that a divergence of a few degrees from the intended take-off line could not introduce obstacles sufficient to cause disaster. Croydon is probably no worse in this respect than many other aerodromes, but it is certainly no better.

An obvious reaction, in view of the fire, is to demand the introduction of Diesel engines. Superficially this sounds attractive, but the matter is not quite as simple as it looks. That, but for the fire, some of the lives might have been saved, seems possible. There is, however, another side to that question. The use of high-octane fuels has enabled the aero engine manufacturer to give a greatly increased power for a short period during the take-off. Coupled with the use of v.p. airscrews, this extra power has improved the take-off of modern aircraft very much. The Diesel engine, unfortunately, does not lend itself to producing such momentary overloads, and if the Diesel-engined aircraft starts with the same "normal" power loading as the petrol-engined aeroplane, it is already at a disadvantage owing to its greater specific weight. If the power loading has to be further reduced to give the Diesel-engined machine the same take-off, the pay load is almost bound to suffer to an extent which may prove prohibitive.

That the Diesel development programme should be revived in this country, *Flight* has already suggested. It is, however, necessary to bear the fundamental drawbacks well in mind. Whatever may be the case in military aircraft, where greater risks can legitimately be run in order to get performance, civil aviation will, sooner or later, have to turn its attention to the Diesel.

There are far too many problems involved to make possible a discussion of the matter here, but perhaps we might make the suggestion that one way of encouraging engine manufacturers to devote some of their resources to the development of the Diesel would be for the Air Ministry to announce that after a certain period of years—two, three or five—no civil aircraft of a certain weight or carrying capacity would be granted a certificate of airworthiness unless fitted with Diesel engines.

OUR KING AS PILOT: A photograph taken at Croydon soon after the War of a 504K Avro, at the controls of which was Prince Albert. Incidentally, London's airport was known in those days as "The Government Aerodrome, Waddon."

The Outlook

A Running Commentary on Air Topics

An Unnecessary Disaster

DURING the air exercises last July two Heyfords came to grief in very thick weather, one of them flying into the top of the Downs and the other alighting in the sea off the coast of France. Last Saturday there was another disaster to Heyfords, this time to a flight of seven machines of No. 102 (Bomber) Squadron, a new formation whose arrival at Finningley was recorded in *Flight* of September 10. The seven machines started from Aldergrove, in Co. Antrim, and only one reached Finningley. One crashed at Hebden Bridge, in Yorkshire, with the loss of three lives, and the crew of another left their machine by parachute. The pilot of the Hebden Bridge machine said that the cause of the crash was ice on the wings, and that may also have been the reason why the crew of the other had to jump. The other four machines seem to have lost their way.

It is very disturbing to think that the heavy bombers of the R.A.F. are apt to lose their way if they fly in murky weather, for in time of war clear weather will be the bomber's worst enemy. In peace time wireless assistance is available, but in time of war it will be a case of instrument-flying, and correct navigation. Ice accretion can sometimes be minimised by climbing quickly through the dangerous layers.

In this case the Meteorological Office could have told the pilots (and probably did tell them) that there was a blanket of fog over the North Midlands; that above this fog there was a cloud layer; and that heavy ice accretion could be expected at certain levels. The pilots knew that the Pennines had to be crossed in such conditions, and it is difficult to find a reason for any suggestion that they did not know their position, since both navigators and radio operators were carried. After all, one machine won through, and therefore it seems that the flight was not only possible but reasonable.

Big Stuff

NOW that the case for the flying boat has been put so admirably by Mr. Arthur Gouge, it is to be hoped that the Royal Aeronautical Society will arrange for a companion lecture, so to speak, to state the case equally well for the landplane. Mr. Gouge afforded us a glimpse of the future, and when he says, quite confidently, that "At the present time there are no problems to be solved in producing a boat of double the weight of the 'Empire' boat which would have, in many respects, improved characteristics," *Flight* is not prepared to dispute the statement; nor, we imagine, is anyone else. Mr. Gouge speaks with authority, and he has never yet promised that which he could not fulfil.

Mr. Gouge's admission that there may be a temporary period when services over long stretches of water are operated by landplanes is interesting. One imagines that what Mr. Gouge has in mind is the possibility of the existence of one of those obsolescence periods to which Major Mayo referred during the discussion of Mr. Gouge's paper During the useful lifetime of the present "C" class flying boats, in other words, it is, perhaps, unlikely that Imperial Airways will order another large batch of boats of twice the weight, and so a period may exist during which certain landplanes, possibly produced for other services as well, may be taken into use for trans-oceanic routes.

In this connection one cannot fail to think of the "all-wing" landplane, an ideal which appears to be rather less difficult of realisation than the "all-wing" seaplane, Dr. Roxbee Cox's scheme notwithstanding. It may well be that if and when the "all-wing" aeroplane is produced, it may be considered safe enough for trans-oceanic air routes because of an inherent ability to float on the sea for long periods. It would, of course, never get off again, but that might conceivably be regarded as a justifiable risk.

Magnified Imperfections

WHEN the Air Ministry announced, some time ago, that a change was to be made in the *format* of the Reports and Memoranda of the Aeronautical Research Committee, there were those who jumped to the conclusion that a great improvement might be expected. The first four or five of the R. & M.s in the new size have now been published, and give very considerable cause for dissatisfaction in several respects, in spite of the fact that the type area is 6in. by 8¼in., compared with the old 4⅜in. by 7⅜in., and the type used for the text is very much larger and clearer, while the paper is of a good deal better quality.

The diagrams which illustrate the R. & M.s have never compared in quality with, for instance, those of the American N.A.C.A. Technical Reports. In some cases, the larger size of the new British reports merely seems to have had the effect of accentuating the indifferent quality of the diagrams and draughtsmanship. The most that can be said in favour of the new size and better paper is that the half-tone illustrations reproduce a good deal better.

The most unsatisfactory feature of the new R. & M.s is, however, that the price seems to have gone up. The old ones were expensive enough in all conscience, but the new size seems to run to an average price of 3s. 6d., which is quite inexcusable.

It may be argued that the aircraft firms and others interested in R. & M.s can well afford to pay 3s. 6d. for them. Unfortunately, there are a great number of young men in our drawing offices and shops whose only chance to see the R. & M.s is to buy them with their own money, and to them an average price of 3s. 6d. puts the publications entirely out of reach. It is not even a case of paying for red-hot information. Most of the R. & M.s are more than a year old when they are published.

The aircraft industry has the responsibility of training its bright young men. By issuing "obsolescent" R. & M.s at 3s. 6d. a time the Air Ministry is not helping it to disseminate aeronautical knowledge.

A Generous Gift

IT may not be pleasing to Socialists, but it is none the less a proof that we live in healthy times, that men who have become rich as a result of the abilities and work they have thrown into the industry of the country should be ready to give large sums of the money, which it has cost them much effort to amass, on helping others.

Recently we have all applauded the munificent gifts of Lord Nuffield to Oxford University and of Lord Austin to Cambridge. Lord Wakefield's benefactions continue to flow in a never-ending stream. His latest gift is one of £10,000 to the R.A.F. Benevolent Fund. The details of the gift are set forth on page 660 of this issue. To praise Lord Wakefield for this generosity would be almost an impertinence. His best thanks will come from the children of R.A.F. officers and airmen whom he will have helped to make a success of life.

The three Short boats which form the subject of Mr. Gouge's paper : (left to right) The Calcutta (three 525 h.p. geared Bristol Jupiters) ; the Kent (four 555 h.p. geared Jupiters) ; and the Empire boat (four 758/815 h.p. Pegasus X Cs).

FLYING-BOAT

A Notable Paper Read Before the R.Ae.S. Design of the Short Empire Boat Co Kent an

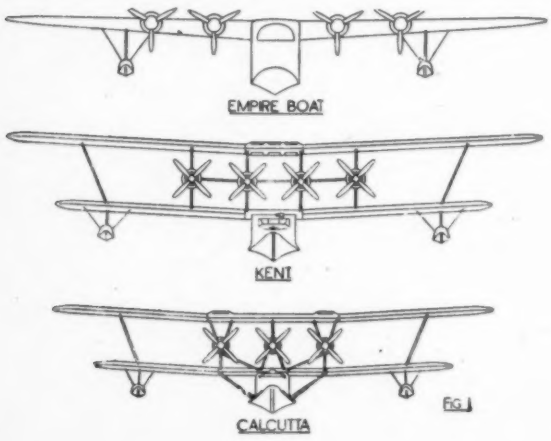
IN one way the paper on civil flying boats read by Mr. Arthur Gouge, general manager of Short Brothers, before the Royal Aeronautical Society last Thursday was peculiarly British. Nearly every page of the paper was a record of some great achievement; and yet, because of his innate modesty, Mr. Gouge read his paper very much as if he had been quoting fat stock prices. The result was that it was difficult to realise, until the very end, that Mr. Gouge *was* placing before his audience a record of quite remarkable achievement.

The applause which followed the paper, from a room more densely packed than we have seen it for a very long time, left no doubt that the audience appreciated both the paper and the work of Mr. Gouge and Short Brothers.

No better example of recent British progress could be found than Mr. Gouge's very lucid explanation of the evolution of the Empire flying boat, and as we feel that it deserves to be known the world over without delay we have decided to publish the paper almost *in extenso*. Owing to its length, and to the considerable number of illustrations, it is not possible to publish the whole paper in this issue of *Flight*, but the concluding part, and a report of the very interesting discussion which followed it, will be published next week.

Mr H. E. Wimperis, Director of Scientific Research at the Air Ministry and President of the Royal Aeronautical Society, was in the chair. Before calling on Mr. Gouge to read the paper Mr. Wimperis said he thought the audience would wish to pay a tribute to the late Señor de la Cierva, who lost his life in the Croydon accident a short time before. Señor de la Cierva, Mr. Wimperis recalled, was a very distinguished engineer and a very welcome member of the Society. He had lectured three times before the Society, and each time his lecture had recorded some advance in the development of the Autogiro. He had personally, as Director of Scientific Research, come into contact with Señor de la Cierva a good deal, and had formed a high opinion of him as an engineer. The Council of the R.Ae.S. had sent a message of condolence to Señora de la Cierva. The audience then stood silent for a few moments.

Mr. Gouge said he had originally intended to give a survey of civil flying boats in general, but had decided the subject was too large and that it would be better for him to review the three types with which he had been connected.



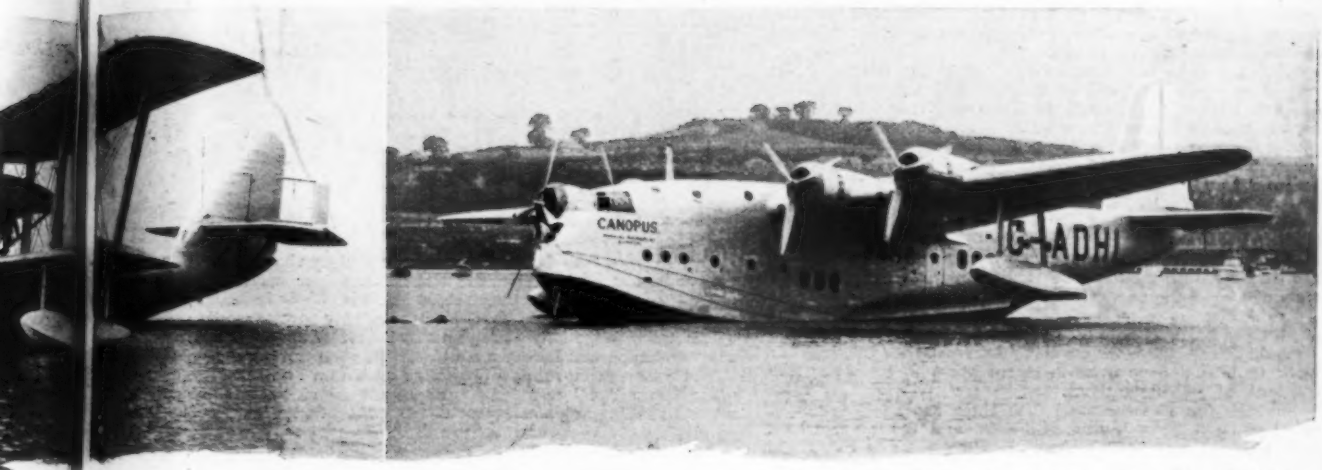
The Paper

These classes, the Calcutta, Kent and Empire boats (said Mr. Gouge), are well known and have all been designed to meet a commercial specification issued either by the Air Ministry or Imperial Airways. They can, therefore, be called civil flying boats in the true sense of the word, and not a development from a military type. In the case of the Calcutta the reverse has happened in that it has been converted into a Service boat both in this country and abroad.

Future trend of development will, I am certain, be a complete divergence of the two types. The Service boat appears, for various reasons, to be approaching a limiting size, whereas no limit is yet in sight for the civil boat, and each succeeding design either built or contemplated is appreciably greater in all-up weight than its predecessor.

The general problems relating to hull form, method of lateral stabilisation and aerodynamic characteristics are, of course, common for both types. Perhaps the main cause for the different treatment of the two types lies in the fact that, in general, the civil boat operates from selected harbours which are equipped with all the ground services essential for efficient and safe operation, whereas the Service boat will or may have to operate under widely varying conditions necessitating more consideration being given to its seaworthiness properties.

For the purposes of this paper, however, we are chiefly concerned with the development on the civil side.



EVOLUTION

by Mr. A. Gouge, B.Sc., F.R.Ae.S. : The pared with That of Its Predecessors, the Calcutta

Fig. 1 shows in front elevation the three boats which form the subject matter of this paper.

The Calcutta was the prototype of our civil boat design and was equipped with three engines, being followed later by the Kent, which had four engines installed. Both of these types were biplanes and of very similar design, the Kent being actually modelled on the Calcutta.

The Empire boat, being a four-engined high-wing monoplane, was a complete departure from the earlier types.

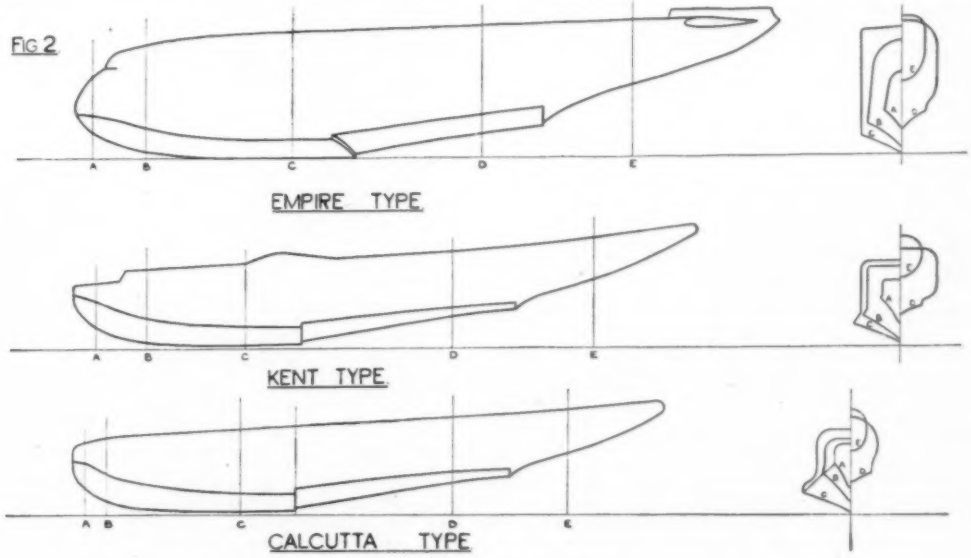
The boats were all constructed of metal, but with some differences in the materials employed. For example, the Calcutta, with the exception of the covering surfaces, was built entirely of duralumin. The Kent was similar, with the important difference that the planing bottom surface was of stainless steel. The Empire boat is built chiefly of Alclad to D.T.D. specification 275, although the spar extrusions are of R.R. 56 alloy. With the exception of the control surfaces, the wings and tail unit are also metal covered. It will probably be asked why a departure was made from the stainless steel bottom, which has given such excellent service on the Kent. Frankly, I think that stainless steel is the ideal material to use for this purpose, but it would probably have involved us in an additional 300 lb. in weight, and with the excellent results now being obtained from Alclad there did not appear sufficient justification for the corresponding loss in pay-load.

Table I gives the summary of the general characteristics, and there are two points which call for some comment.

TABLE I.

General data.	Calcutta.	Kent.	Empire Boat.
Wing area, sq. ft.	1,815	2,640	1,500
Engine, b.h.p., maximum	1,605	2,332	3,180
Engine, b.h.p., normal	1,515	2,140	2,960
Wing loading, lb./sq. ft.	12.4	12.3	27
Power loading, lb./h.p., normal ...	14.9	15.2	13.7
Hull beam, ft.	10.0	11.25	10.0
Hull length, ft.	60.5	71.9	88.0
Year of construction	1928	1931	1936

The first relates to the wing loading. It will be noted that the wing loadings are approximately the same for both the Calcutta and Kent, whereas the Empire boat, at the normal weight, has a wing loading of 27 lb./sq. ft., which is more



than double that of the earlier boats. This point will be further discussed when the performances of the respective machines are being considered.

Secondly, attention should be called to the beams of the respective boats. It will be noticed that the beam of the Calcutta is 10 ft. and that of the Kent 11 ft. 3 in., these being proportional to the cube root of the respective all-up weights. For some time past it has been my conviction that it should be possible to build hulls with a much narrower beam than was our accepted practice without incurring any appreciable loss in hydrodynamic efficiency. An extensive series of tank tests were put in hand, and it was finally found possible to limit the beam of the Empire boat to 10 ft., as against a beam of approximately 12 ft. 3 in. that would have been needed on the earlier requirements. The results obtained from the tank tests will be discussed later.

Again referring to the table, it will be noted that the engines of all three boats were built by the Bristol Aeroplane Co., and I should like to pay a tribute to this company for the valuable work that they have done in recent years in furthering the cause of the civil flying boat.

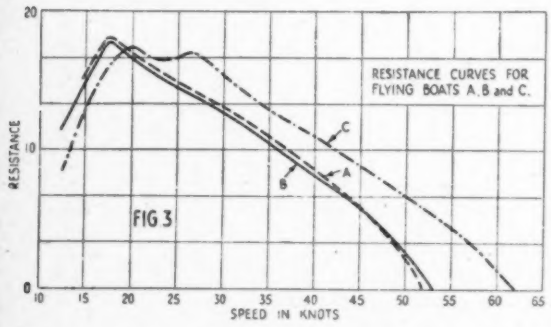
The Calcutta was equipped with three Jupiter IX engines, the Kent with four Jupiter X FBMs, and the Empire boat with four Pegasus X Cs. An interesting point to observe is that the power loading of the Empire boat is about 11 per cent. better than that of the Kent.

Fig. 2 has been prepared to illustrate the differences between the respective hulls, and they have been drawn on the basis of a common weight in order that they should be directly comparable. The relative data are as follows:—

	A. Calcutta.	B. Kent.	C. Empire Boat.
Take-off speed (knots)	56	57	68
Lbs. of gross weight/inch of beam ...	187.5	240	338
Overall length/beam	6.05	6.39	8.8

The first point that arises from a study of the diagrams is the comparatively greater length of the "C" type hull. The overall length is, of course, governed by aerodynamic considerations and at the moment does not directly concern the comparisons, but I do wish to draw attention to the greatly increased depth of hull employed on the "C" type. Two main reasons are responsible for this depth:—

(1) The cubic capacity required for accommodation of passengers, mail, baggage, etc.; and
(2) The necessity of providing adequate water clearance for the flaps and airscrews.



The lengths of the forebody planing surfaces are approximately the same for types "A" and "B," but type "C" has a longer forebody, found necessary on account of the beam reduction. The decrease in the beam is distinctly shown in the sections and amounts to approximately 20 per cent. The afterbody length of the "C" type boat, however, does not show the same disparity. This, again, was determined from the tank tests as it was desired to keep down this length to a minimum consistent with adequate longitudinal stability when planing.

The considerably higher wing loading, combined with the desirability of improving the aerodynamic shape of the hull, resulted in some sacrifice being made in the water performances, and Fig 3 shows the comparative resistance curves of the three hulls based on the same all-up weight. The curves have not been plotted in non-dimensional form, as it was desired to illustrate the higher water resistance of the "C" type hull at speeds above 20 knots, which is due entirely to the narrower beam and higher take-off speed consequent upon the increased loading.

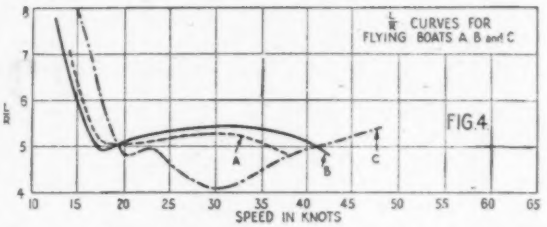
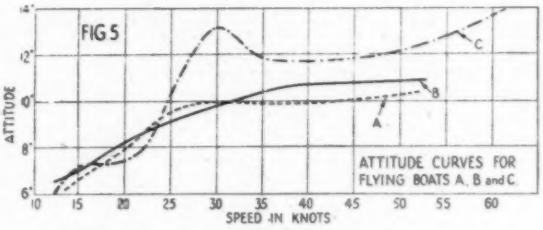


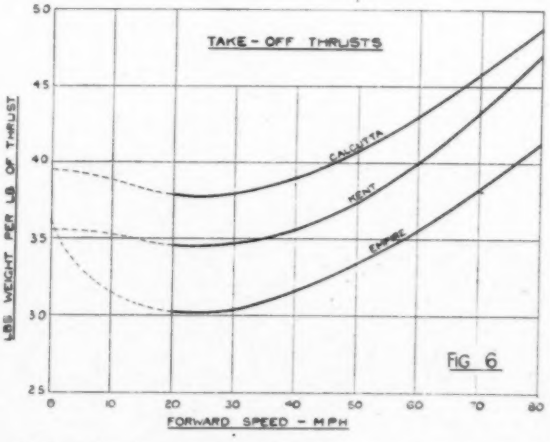
Fig. 4 shows the efficiency curves measured by the ratio load on the water divided by the resistance. The sacrifice in efficiency resulting from the reduced beam is clearly indicated, although it will be noted that this applies only to that portion of the speed range between 25 and 40 knots. Above 40 knots the "C" type hull becomes more efficient than the other two.

The comparative running angles are shown on Fig. 5. Here again types "A" and "B" are very similar, whereas the natural running angle of type "C" is greater at speeds above 25 knots.

In considering these sets of curves it might be questioned as to why a hull with a basic increase in resistance could be accepted. Normally we should have considered this a retrograde step, but as we were able in this design to employ two-pitch airscrews, the increase in thrust at take-off more than compensated for the increased water resistance.



In Fig. 6 an attempt has been made to estimate the respective thrust for the three boats, the thrusts being given as a function of the all-up weight. If the thrust at 30 knots given by the airscrews of the Calcutta be compared with the thrust obtained from the airscrews of the Empire boat, it will be seen that, whereas the Calcutta gives 1 lb. of thrust for every 3.8 lb. of dead weight, the Empire boat gives 1 lb. of thrust for every 3.05 lb. of weight. In the case of the Kent 1 lb. of thrust is available for every 3.45 lb. of weight.



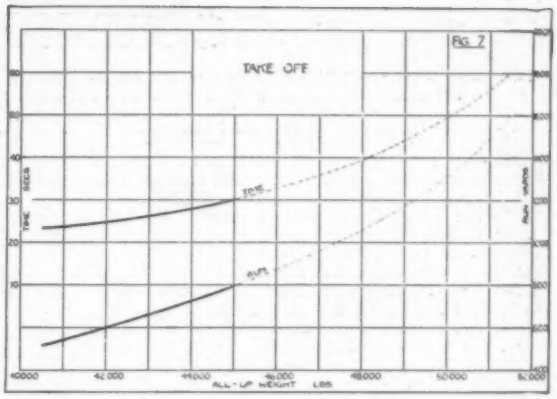
Modern developments in engines have given, by the use of higher octane fuels, larger take-off powers, which, combined with the controllable-pitch airscrew, have enabled us to take full advantage of the narrow beam and the high wing loadings without unduly sacrificing the take-off characteristics. Opinions may be divergent as to what is considered a suitable take-off, but there is no doubt in my mind that for the type

of boat we are considering (which has, of necessity, to operate from widely different waters) the run and time of take-off should be about 500-600 yards and 20-25 sec. respectively. For special routes operating from suitably selected harbours a longer take-off could be permitted, and to this I will refer later.

It is interesting to compare the results obtained in practice for the three boats. On reference to Table II it will be seen that the take-off of the Empire boat is slightly worse than that of the Calcutta, but distinctly better than that of the Kent. The take-off time of the Empire boat is that from the time of full throttle, and with the hydraulic type of engine controls fitted it takes from 3-3½ sec. to obtain full throttle. Therefore, in spite of the very considerable increase in wing loading the take-off time remains practically unaltered. The take-off speed, however, is appreciably affected, increasing from 56 knots to 68, and this has the effect of prolonging the run.

Two of the Empire boats are being placed in a special C. of A. category to enable flight tests to be carried out at an all-up weight of 45,000 lb., and tests have been made on the effect of the take-off at this increased weight. These tests showed that the take-off time was increased to 30.5 sec. (again from full opening of the throttles) and the run to 795 yards, figures which are still reasonable and probably quite safe for operation from a large number of the available harbours. The I.C.A.N. requirements state that the take-off from calm water must be less than 60 sec. with no wind. From the tests which have been carried out at two different weights on the Empire boat, a fairly accurate prediction can be made of the limiting weight at which this type of boat can leave the water and still meet with I.C.A.N. requirements.

Fig. 7 shows the relation between the take-off time and the all-up weight. If the assumptions made are reasonably correct the boat could be loaded up to 51,500 lb. before exceeding the limiting time. The wing loading would then be 34.3 lb./sq. ft., which is considerably higher than is used on any known aeroplane operating at the present time. Provided selected harbours can be used, this fact opens up interesting possibilities for the future. It must be borne in mind that we have by no means reached the limits of available thrust, as improvements will undoubtedly be made in the ground power of engines combined with a two-speed gear and the static efficiency of the airscrews. To what extent this improvement can be made it is difficult to surmise, but one can foresee that boats may be operating under their own power up to a wing loading of approximately 40 lb./sq. ft. I would not advocate such loadings being used on small boats, but only for the development from the size of the Empire boat which may be contemplated.



It is only fair to point out that the theoretical limiting weight shown on the curve may not be realised in actual practice as the water conditions caused by operating the boat in such an overloaded condition may somewhat limit the weight. Complete tank tests would need to be carried out to establish this point, and it would probably be found necessary to increase the beam slightly to avoid the hull becoming too "dirty."

This analysis of the limiting take-off weight for the Empire boat more or less confirms my investigations into the same problem in 1927, when it was established, in my own point of view, that the limiting take-off weight is independent of wing loading. Even so, the actual take-off of the Empire boat at weights above the normal has exceeded our most optimistic estimates.

It is, of course, almost essential, when these high wing loadings are employed, to use some form of flap in order to assist the take-off. As is well known, several types of flap are now in common use, and these can be roughly divided into two groups, namely, those having high and low drag respectively. In the particular case of the flying boat a steep angle of glide when coming in to land is not of vital importance, and therefore it is better to fit a type of flap which, as much as possible, can be used for the take-off.

(*To be concluded next week.*)

Green Spaces

THE Lord Mayor of London announced recently that a special appeal is being made in January on behalf of the King George Memorial Fund. Those who see England from the air are especially conscious of the absence of green oases in our black industrial areas. This is a misfortune which the King George Memorial Fund will remedy by providing playing fields all over the country.

New Titanine Director

IT is announced that Sir Alfred Beit, Bt., M.P., has joined the board of Titanine, Ltd. Sir Alfred, who has represented St. Pancras South East in Parliament since 1931, has taken a keen interest in aviation for a number of years.

Since the appearance of Titanine, Ltd., as a public company earlier this year a 50 per cent. expansion has, it is stated, taken place in the Company's works at Colindale.

APPROACH TO A PROBLEM—I: This view of the Fairey Battle medium bomber (1,065 h.p. Rolls-Royce Merlin) affords an interesting comparison with the Armstrong Whitworth machine illustrated on pages 651 and 663 of this issue and intended for similar duties. Note the revised cockpit enclosure and undercarriage and the D.H. v.p. airscrew. (*Flight* photograph.)

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases, accompany letters intended for publication in these columns.

THE AIRPORT OF LONDON

THE disastrous accident to the Dutch air liner at Croydon on Wednesday of last week draws one's attention to London's airport position.

I do not wish to give a wrong impression by linking one matter with another in false relationship, and the cause of the accident will no doubt be clearly established by expert enquiry, but any possibility of fouling buildings or other "obstacles" bordering on or in the neighbourhood of the airport calls for serious consideration of our terminal facilities.

I do not pretend to be an expert on airport planning, so may I ask if we are wholly satisfied with our present arrangements? It should not be a matter of "reasonably adequate"; London deserves an airways terminus second to none in dimensions, surface, surrounding protection, appliances, buildings, etc. When one considers the enormous expenditure on arterial roads and public services generally, is it not permissible now to be really extravagant over one metropolitan airport worthy of the greatest city in the world?

Hatfield. F.E.N. ST. BARBE.

TAPERED WINGS

IN a letter addressed to *Flight* of December 10 Mr. Stanley H. Evans makes the following statement: "Aerodynamically, I feel that trapezoidal plan forms with high taper ratios between 4 and 5, such as Dr. Lachmann advocates in his paper, are every bit as bad as those rectangular planks of the past." He also complains about the "almost total absence of experimental data on elliptical wings," a fact which strikes him as "a most astonishing example of scientific blindness."

As far as induced drag is concerned, the generally accepted aerofoil theory shows that the induced drag of a rectangular aerofoil is slightly higher than the minimum induced drag which follows for an elliptical plan form. For example, assuming an aspect ratio of 6.28, the increase of induced drag of the rectangular plan form according to Glauert is 4.9 per cent.

For a tapered wing the increase is much less. For example, a tapered wing of aspect ratio 6.28 having a taper ratio of 2 would experience an increase of only 1.1 per cent. in regard to induced drag, and at a taper ratio of 4 this increase would only be 1.6 per cent.

The advantage in regard to induced drag of an elliptical plan form over a trapezoidal one of taper ratio <4 is therefore very small. Considering that the part played by induced drag in the total drag balance is only of the order of 4 to 6 per cent. for modern fast aircraft (top speed condition), the influence of plan form is negligible as far as top speed and cruising speed are concerned, and quite unimportant for the climb in view of the relatively low h.p. loadings now generally used.

As far as profile drag is concerned, it is difficult to imagine why the elliptical plan form should have a particular advantage. The influence of plan form was investigated in Göttingen some years ago, and the results are published on page 63 in the first report of the Göttingen Aerodynamic Institute (1925). A careful analysis of the results published for a rectangular, an elliptical and a tapered wing (taper ratio 1.75), taking into account corrections for the induced drag due to plan form, give the following results in regard to minimum profile drag:—

Rectangular wing Cd min = 0.0095
Elliptical wing Cd min = 0.0091
Trapezoidal wing Cd min = 0.0086

If anything, the advantage in regard to the profile drag is, therefore, with the trapezoidal wing, although one should not place too much importance on this fact in view of the small order of the difference and the influence of possible errors.

The Reynolds number at which these tests were conducted was 420,000, which is admittedly not very high, but for the tunnel in which these tests were conducted the profile drag of well-shaped wing sections has been found to be invariant of Reynolds number up to values of $R = 1.75 \times 10^6$.

It is difficult to visualise why plan form and Reynolds number should be connected with each other in a way resulting in a definite superiority of the elliptical over the trapezoidal plan form at high Reynolds numbers. Obviously, the elliptical plan form is very attractive from an æsthetic point of view, and, in fact, on designing a wing of very low aspect ratio (for example, a tail plane) one is almost forced to adopt it for pure geometrical reasons. However, what is pleasing to the eye is not always aerodynamically superior to a simpler shape.

It would be interesting to hear from Mr. Evans what rational reasons he has to expect "better" results with elliptical plan forms, and in what direction any improvements, beyond those mentioned above, are to be expected. Unless he does so I consider the Editor's expression "the fetish of the elliptical plan form" a most fitting characterisation.

Cricklewood. G. V. LACHMANN.

THOSE LANDING FEES

IT was interesing to read in last week's *Flight*, under "Topics of the Day," some reference to the question of landing fees—somewhat belated, methinks. [This was not by any means our first reference to the subject.—ED.]

During the last four years I have landed dozens of times at nearly every civil aerodrome in Great Britain (and a few Service stations), and during the last ten months this company has made over 800 landings, spread over nearly all the civil aerodromes in Great Britain, both private and official. It is hard to pick out *two* where the charges and the service are the same. The great discrepancy, not only in landing fees, but in hangarage and "service," etc., has shown such an astounding variation that it has become irritating, and leads to much argument and ill-feeling, so much so that one wonders why the Royal Aero Club, or the Department of Civil Aviation, or some such authority, does not take the matter up.

These landing fees, the fuel purchased, hangarage charges, etc., quite apart from tips, and the money spent by the pilots themselves in the various clubs and restaurants on food and refreshment, etc., have amounted, as far as this company is concerned, to well over £1,300 this year. When it is borne in mind that one machine may make as many as half a dozen landings on the same aerodrome in one day, I do feel, like your contributor "Indicator," that the landing fee rule might be applied "with less rigidity and more discretion."

If I land at an aerodrome solely for my own convenience and spend no money on fuel or refreshment, I have no objection to paying a landing fee, but when I buy large quantities of fuel, far more than the average visiting pilot—in one case this year over 150 gallons of petrol in one day—and pay hangarage as well, it is more than irritating to be rushed at by "an unsmiling man in uniform" (or not) "with a pretty receipt book."

Some of these aerodromes welcome one with open arms, offer every kind of free and willing service, and are more than content with what they make out of the sale of fuel; others make a point of squeezing every penny they can and begrudge even the provision of a pair of chocks.

During 1936 we have run our *own* "service" and have not called on any local assistance, not even to open a hangar door, which makes it still more annoying.

It may be argued that as a commercial company we must expect to "pay for it," but anyone in any business will know how these things count, and if the privately owned (expensive property at that) or the municipal airports (taxpayers' money) or the Government-owned aerodromes (still taxpayers' money) wish to encourage visiting aircraft, especially those who pay on the nail, they might ponder these points. With the general increase in the number of such aerodromes, it is becoming increasingly easy to pick and choose. C. DRAPER,

London, W.C.2. Chairman, Plane Advertising, Ltd.

Publishers' Announcement
CHRISTMAS HOLIDAY

Miscellaneous Advertisements intended for the issue of December 24 must be in our hands by first post on Monday, December 21.

This issue will be on sale one day earlier than usual, i.e., on Wednesday, December 23.

FLIGHT PUBLISHING CO., LTD.

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

PROTOTYPE I. The new Armstrong Whitworth P. 27/32 medium bomber with Siddeley Tiger VIII fourteen-cylinder engine. The turret is of Armstrong Whitworth design. (*R.A.F. Official photograph.*)

LORD WAKEFIELD has presented the Toronto Flying Club with a Percival Vega Gull.

The United States 16-ton Boeing bomber (4 Wright Cyclone G.s), after making successful test flights recently, crashed in landing at Seattle.

It has been officially announced that within two years fifty-passenger machines of 150-feet span will be operating on the transcontinental routes of the American T.W.A. concern.

The Swedish Air Force has placed an order for 36 Junkers type 82 bombers. The first is to be delivered in a few days. Bristol engines built under licence in Sweden are to be fitted.

Following successful events in 1922, 1927 and 1933, the Aero Club de Suisse has decided to hold a big international aviation meeting at Zurich from July 23 to August 1.

Last Thursday Mr. W. Lindsay Everard entertained to luncheon at the R.Ae.C. the organising committee of the 1936 Week-end Aerien.

It was reported that expenses of the Week-end Aerien had totalled £2,054 4s. 9d., while donations had amounted to £2,102 14s. The balance of £48 9s. 3d. would be credited to the hospitality fund of the R.Ae.C.

An Austrian Government decree orders that aircraft crossing the Austro-Italian frontier, which is some 120 miles long, shall in future keep to two specified routes, one over the Brenner, in Tyrol, and one in Carinthia. They may not normally diverge more than one mile in either direction or fly lower than 6,500ft.

Flying a Cant Zappata 506 Captain Mario Stoppani broke for Italy two class C2 world's altitude records for payloads of 2,000 and 5,000 kg., the former on November 29, when he reached 25,692ft. (the previous record was held by France at 24,627ft.), and the latter on December 1, when he reached 22,071ft. This record was previously held by America with 20,406ft.

To-night Prof. B. Melvill Jones, A.F.C., M.A., F.R.Ae.S., will lecture before the R.Ae.S. on "Profile Drag." "The object of my lecture," says Prof. Jones, "is to discuss skin friction, more from the point of view of the practical man who has to use the information, than from that of the research worker who is studying it."

Prof. Melvill Jones discusses the boundary layer and the aerodynamically smooth surface, and gives typical values of skin friction and boundary layer thickness. He shows how with the exploring pitot tube it has become possible to study the drag on any part of an aeroplane in flight.

At the Leipzig Engineering and Building Fair, to be held from February 28 until March 8, a complete review of the advance made in the aerial defence industry will be presented. Gas-proof doors and window frames, flame-proof blinds, and various types of fire extinguishers, fire-protection paints and impregnating agents will be shown and demonstrated.

Twenty-five Years Ago

(From "Flight" of December 16, 1911.)

"Col. Capper laid it down as a first essential that the military aeroplane should be regarded as a means of reconnaissance rather than a fighting vehicle. . . . If the gun is admitted as a *necessity*, then something in the way of automatic, or nearly automatic, stability is of first importance, in order to secure a reasonably steady gun-platform."

PROTOTYPE II. The Fairey light reconnaissance seaplane intended for operation from warships. A Napier Rapier VI moderately supercharged engine is fitted.

A D.H. OCCASION

Nearly 900 De Havillandians Celebrate a Good Year

THAT the D.H.91, or Albatross, is now nearing completion at the Hatfield Works of the De Havilland Aircraft Co. and is expected to fly during the next month or so, was announced by Mr. A. S. Butler, chairman of the Company, at the annual dinner held at Harrod's Restaurant, London, last Saturday.

Mr. Butler announced that this dinner, the twelfth in the history of the company, was the largest gathering that they had ever had, nearly 900 being present. Their only disappointment was that Capt. de Havilland was unable to attend. Mr. Butler recalled that an enormous expansion had taken place in the industry generally, and the most important effect of this on the De Havilland company was that it had led to the separation of their three main activities into separate divisions. [This reorganisation was explained in a paragraph on page 633 of last week's issue of *Flight*.—Ed.]

It was something for the company to be proud of, said Mr. Butler, when he pointed out that there was a De Havilland aircraft flying every minute of the 24 hours on regular airlines or in the hands of aircraft operators in various parts of the world.

On the engine side of the business the output again constituted a record. The total horse-power of the engines produced during the year was 135,000 against 119,000 last year. He took the opportunity to congratulate Major Halford and his design staff.

Other interesting points made by Mr. Butler included the fact that the new works at Bolton, Lancashire, with which the Government had entrusted the company (and of which, incidentally, Mr. J. V. Holman is to be general manager), were to be even larger than the present one at Stag Lane; that the flying hours of the R.A.F. civil training school at Hatfield had risen from 6,000 to about 8,800, while the school at Maidenhead, which only started in November, 1935, had already completed over 8,600 hours; and that the number of students at the D.H. Technical School had now grown to 158.

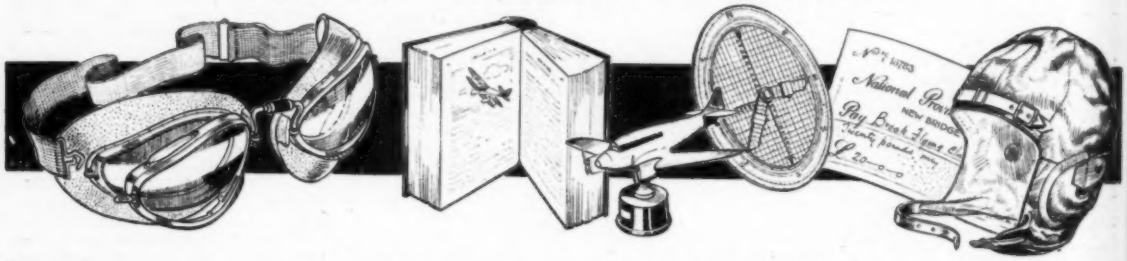
Turning to the future, Mr. Butler regretted that he was not able to disclose very much information. The airscrew division, however, would be developing the constant-speed airscrew, which he believed would play an important part in the future, while the engine division was producing an engine of great promise in the Gipsy Twelve, and they would be interested to know that orders had been placed for this type which would keep the engine factory busy for over two years. Finally, the D.H.91 was the biggest commercial type ever undertaken by the De Havilland designers, being over twice the size of their previous largest machine.

Mr. T. D. Williams, in proposing the toast of the guests, mentioned in particular the name of Mr. C. W. A. Scott, and recalled the many flights made by him behind De Havilland Gipsy engines.

Mr. Scott, in reply, recalled that his association with the De Havilland Company dated back no less than twelve years. It began when he was in the R.A.F. and, with several others, went to Brockworth to collect a number of Gloster Grebes. During this flight fog came up and the formation had to break up. He was formating with the Squadron leader, and they suddenly found themselves over Stag Lane. The C.O. landed, but instead of putting down on Stag Lane aerodrome he landed on an adjoining football field, scoring an excellent goal with his Jaguar engine. The first De Havilland machine Mr. Scott had flown was the D.H.4. Since those early days he had done 4,000 hours behind De Havilland engines and he had never had a forced landing due to engine trouble.

BY THESE PRESENTS . . .

A Helpful Note on a Seasonable but Difficult Subject



THE time has yet to come when it will be a recognised pre-Christmas procedure to send our friends and relatives a list of the presents we hope to receive. At the moment we hesitate to write to Uncle Bill: "I intend to buy you a packet of cigarettes for Christmas; would you please order a Giles Vega Six to be sent to Hatfield for me?" Seriously, however, no present would be more appreciated by son or daughter, nephew or niece, than, say, a receipt for a cheque covering a course of flying instruction.

Other presents would not be hard to think of, for there are many gifts that are always acceptable to flying folk. For instance, a range of first-class flying goggles is available from E. B. Meyrowitz, Ltd., of 1a, Old Bond Street, London, W.1. Further goggles, helmets, gauntlets, and smart kit of all kinds can be seen at such stores as those of D. Lewis, Ltd., of 124, Great Portland Street, London, W.1, and S. Lewis, 27, Carburton Street, London, W.1.

A C.D.C. (for the benefit of Uncle Bill, course and distance calculator) makes a practical gift for the budding cross-country pilot. Well-known varieties are marketed by Smiths' Aircraft Instruments, of Cricklewood, London, N.W.2, and Simmonds Accessories, Ltd., 55, Turnmill Street, London, E.C.1.

Maps of all kinds are offered by Airco, Ltd., of 3, St. James's Square, London, S.W.1, who also supply clothing. Depending upon the types of aircraft flown, Mallock-Armstrong ear defenders, obtainable at 39, Victoria Street, London, S.W.1, may be very acceptable; and Moseley "Float-on-Air" cushions are useful at home or in car or aeroplane.

A canvas and cowhide Zipp-fastening, lightweight bag as sold by Moss Brothers and Co., Ltd., Covent Garden, London, W.C.2, is a very handy addition to one's travelling kit. This firm offer also a specially designed two-piece flying suit. To complete the selection, Burberry, Ltd., of Haymarket, London, S.W.1, Dunlop—or one of their many agents—Alkit, Ltd., Cambridge Circus, London, W.1, and Gieves, Ltd., of 21, Old Bond Street, London, W.1, all supply flying clothing. The last-named have also an attractive range of jewellery incorporating the R.A.F. badge.

No more pleasing ornament or mascot can be obtained than a scale-model aircraft. Models of any type can be made by experts from photographs or drawings. Estimates will be given on request at The Goldsmiths and Silversmiths Co., Ltd., 112, Regent Street, London, W.1.

Books dealing with every aspect of flying, aeroplanes, and aero engines are presents which never fail to please. From week to week book reviews have appeared in *Flight* which may help in making a choice. A list of the best books on aviation generally is issued by Sir Isaac Pitman, Ltd., Parker Street, Kingsway, London, W.C.2, and a useful register is also kept by the Phœnix Book Co., Ltd., 66, Chandos Street, London, W.C.2. Another publisher of aeronautical works—technical ones especially—is the McGraw Hill Publishing Co., Ltd., Aldwych House, London, W.C.2. There are still copies available of the book *Squadrons of the Royal Air Force*, which proved so popular when published by *Flight* last year.

Finally, it is never a mistake to buy one of Player's special presentation boxes of cigarettes, cigars or tobacco, of which there are many sizes and kinds.

LOCKHEEDS in ENGLAND

Rollason Aircraft Services Sole Distributors for Lockheed Machines : First Particulars of the 250 m.p.h. Super Electra

THE gospel of speed has been preached by the Lockheed organisation since its inception in 1928, and the past seven years have seen some of the finest commercial aircraft in the world emanate from its plant. Never allowing itself to be trammelled by orthodox practice in structural or aerodynamic design, Lockheed's have built aircraft noteworthy not only for their outstanding performance but for ingenuity of design and, considering their speed, economy of operation; so Rollason Aircraft Services, who have obtained the sole distributorship for the Lockheed range in this country, may count themselves fortunate.

The Vega high-wing monoplane enjoyed long popularity and figured in many a notable performance. This type was followed by the Air Express, Sirius, Altair and Orion, all names to conjure with in their day, and, more recently, by the twin-engined Electra and "12" models of all-metal construction. The very latest Lockheed type, preliminary details of which have only just come to hand, is the Model 14, or Super Electra.

The Electra was originally described in *Flight* of January 25, 1934. This model is of low-wing design with accommodation for ten passengers. Two Pratt and Whitney Wasp Junior nine-cylinder radials are normally specified, giving 400 h.p. each at 5,000 ft., and the maximum speed, with these power plants, is 210 m.p.h. Thus powered the machine is known as the Electra 10A, with Wright Whirlwinds as the 10B, and with Wasps as the 10E.

The Model "12"

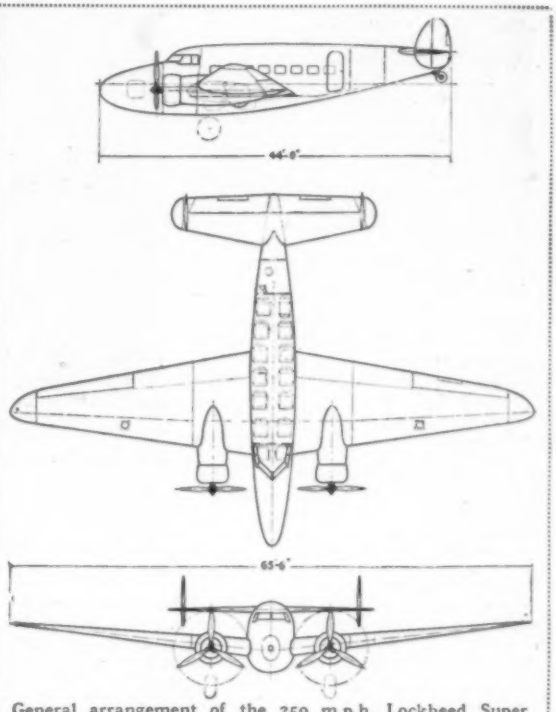
A new and smaller machine, produced in the first instance for a competition, organised by the U.S. Department of Commerce, for small twin-engined transports, the Model "12," is now on the market as a commercial and "executive" type.

The "12s" so far constructed have been fitted with a pair of Pratt and Whitney Wasp Juniors (400 h.p. each), but alternative power plants are the Wright Whirlwind (seven- or nine-cylinder) and the new 290 h.p. six-cylinder Menasco.

Structurally, the "12" follows Electra practice, being of all-metal stressed-skin construction. The wing has a single shear beam and incorporates heavy corrugations on the inside but its exterior is smooth. A monocoque structure, the fuselage has transverse and longitudinal stringers of channel section and is of approximately the same cross section as the Electra. Including the pilot's compartment the cabin is 14 ft. 8 in. long, the width is 5 ft. and the total volume is 285 cu. ft. At the rear end are lavatory facilities and a baggage compartment of 33 cu. ft. capacity.

As with the Electra, the centre section is cut away, permitting the fuselage to be placed partly within the wing and reducing frontal area.

At sea level the "12" takes off in 600 feet and is capable of 226 m.p.h. at 5,000 ft. with Wasp Juniors. A cruising speed of 213 m.p.h. is attainable at 9,600 ft., and the ceiling with full load is over 25,000 ft. Operating on 60 per cent. of the available power, the range is 650 miles.



General arrangement of the 250 m.p.h. Lockheed Super Electra.

The early part of next year should see the Super Electra, a much larger machine than any hitherto produced by Lockheeds, take the air. The following data are estimated for the machine as fitted with two Pratt and Whitney Hornet S1EG nine-cylinder radials of 750 h.p.

Gross and empty weights are, respectively, 15,000 lb. and 9,308 lb., giving a wing loading of 27.2 lb. sq. ft. With flaps it is calculated that the machine will take off in 680 ft. The single-engine ceiling is no less than 10,300 ft. with full load, and with both engines in operation the ceiling is 24,900 ft. At 5,000 ft. the rate of climb is 1,465 ft./min. A speed of 230 m.p.h. is attainable at sea level with each engine delivering 710 h.p.; at 5,000 ft. the figure is 242 m.p.h.; and at 7,000 ft., with the Hornets developing their full 750 h.p., the machine is expected to do 250 m.p.h.

Comper Aeroplanes Ltd.

MENTION was recently made in *Flight* of certain changes to be made in the firm of Comper and Walker. These have now taken place, and in future the company will be known as Comper Aeroplanes, Ltd. There is, of course, more than a mere change of name involved, and the firm will reintroduce aircraft bearing the familiar name, although the types will be totally different from anything previously produced by Flt.-Lt. N. Comper.

The management of the reconstituted company will continue under the guidance of Lord Ronald Graham and Flt.-Lt. Comper, but Mr. F. R. Walker is retiring from active participation; his place will be taken in due course by others, when the company's activities extend.

Comper Aeroplanes, Ltd., will remain at the old address, 86, Strand, London, W.C.2, but as previously announced, the advisory work will be maintained and to it will be added actual design work of all kinds, not only on behalf of clients but also for the company itself. The drawing office, which has been established, has already progressed a long way with the designs for a new machine, the Comper Commerce, which, in model form at any rate, looks remarkably attractive and practical. The Commerce is intended for the home market, while a second type, the Dominion, is specially designed for overseas conditions.

D. S. R. to Retire

THE aviation community will have learnt with a good deal of regret that the Director of Scientific Research at the Air Ministry is to relinquish his post on March 1, 1937. During his term of office Mr. Wimperis has won the regard and affection of all with whom he has come into contact, and all will wish him every possible good fortune when, on leaving the Air Ministry, he goes to Australia at the invitation of the Australian Government to advise them on aeronautical research organisation.

JUAN de la CIERVA

A Very Great Inventor Loses His Life in an Aeroplane Accident : His Work Will Go On

RARELY in the history of aviation has the irony of fate manifested itself more cruelly than when Señor Juan de la Cierva, the famous inventor of the Autogiro, lost his life last week with many others in the accident to the K.L.M. Douglas at Croydon. As many as fifteen years ago Cierva became imbued with the idea that the orthodox aeroplane was an illogical and rather dangerous type of aircraft, and that the logical solution of the problem of safety in flight would be found if some means could be evolved whereby the supporting surface of the aircraft could be kept moving at its proper flying speed, irrespective of the forward speed of the aircraft as a whole. At first the problem must have appeared well-nigh insoluble, but Cierva persisted, and step by difficult step he evolved the Autogiro as we know it to-day. Let it not be thought that the idea came to him fully matured or with even the main problems solved. It did not and could not. Helicopters had been suggested, some had even been built, and "hops" had been made, but these facts did not really help Cierva very much. Not until he discovered that it was possible to leave the rotor free to rotate without being driven by the engine did the basis of the fundamental principle of the Autogiro begin to take form in his brain.

Even when Cierva realised the "windmilling" properties of a lifting airscrew he had a long way to go. His earliest machines had rigid rotor blades, and it was not long before Cierva was reminded by crashed machines that the forward-moving blade gave more lift than the rearward-moving. Off-setting and tilting the axis of the rotor head proved a palliative rather than a cure, and for a time Cierva almost despaired of finding a solution. Then came to him the idea of hinging the rotor blades. This gave the blades freedom to adapt themselves to the varying lift conditions along their circular path, and a very great step had been made towards solving the main problem. There were, however, a great number of secondary problems, and these occupied Cierva for many years; in fact, one might say that they took up most of his time until the "autodynamic" rotor head idea came to him.

First Description

The first reference to the Cierva Autogiro to be published in a British aviation journal appeared in *Flight* of May 24, 1923, when we published a number of photographs of an early four-bladed Autogiro and a short description of the machine, with a statement that the rotor blades were not driven by the engine, but solely by the action of the relative wind. On September 20 of the same year *Flight* published a second article on the Autogiro, illustrated by photographs and a diagram of the forces on the blades. From that early date onwards *Flight* may claim to have believed in the ultimate success of the Autogiro although there were at that time many who scoffed at the idea.

Not until 1925 did Cierva bring one of his machines to this country. It must always be to the everlasting credit of Mr. H. E. Wimperis, Director of Scientific Research at the Air Ministry, that practically all subsequent development work on the Autogiro was done in Great Britain. He realised the great potential advantages of the rotating-wing type of aircraft and decreed that Air Ministry support should be given to this ingenious young Spanish inventor who had had the brains to scheme out for himself a method of getting lift different from any previously tried. Captain Frank Courtney flew the machine over Laffan's Plain, Farnborough, on October 19, 1925, before a distinguished gathering, including Air Vice-Marshal Sir Geoffrey Salmond, Air Chief Marshal Sir Hugh (now Lord) Trenchard, Sir Sefton Brancker, and Sir Samuel Hoare, the last named being Air Minister at the time. Courtney reported the flying to be "rather easier than driving a bus."

The machine flown by Courtney had an Avro 504 fuselage, lateral beams carrying ailerons, and a four-bladed rotor. The rotor blades were started by winding a rope around a drum on the rotor head, mechanics "running out" with the rope and setting the rotor blades moving. The machine was then taxied around the aerodrome until the rotor speed was sufficient to enable the machine to take off.

Not long after this, the British Cierva Autogiro Company was formed, and a period of research and development began, mainly with the financial backing of Lord Weir of Eastwood and his brother, Air Commodore J. G. Weir, of the famous Glasgow firm of engineers. To them also a tribute must be paid for their support of Cierva during his most difficult period.

The next step in the evolution of the Autogiro came when Cierva hit upon the idea of using a biplane tail, one wing of which could be tilted to deflect the slip-stream of the airscrew on to the rotor blades and start them. The fixed wings were retained for several years, but they in turn disappeared and the controllable rotor head took over the functions of ailerons and rudder. Also, starting of the rotor was done by a clutch drive from the engine, thus reducing the running-up time very much.

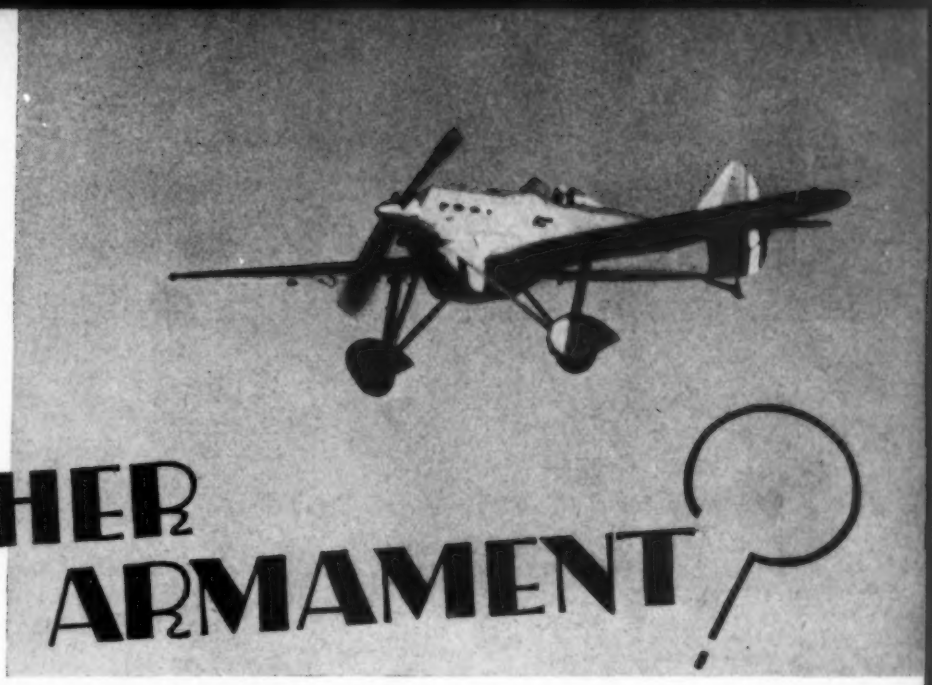
Finally, the step which was to result in the direct-start or "jump-start" autogiro was taken when Cierva introduced the sloping hinges in his blade roots. These enabled the blade incidence to be reduced to no-lift conditions, thus making it possible to speed-up the rotor in excess of the speed required for flight, the energy stored in the rotor being used to give an excess of lift for jumping into the air when the blade incidence was suddenly increased.

The "Autodynamic" Head

Although the sloping hinges and the type of rotor head originally used with them did make jump-starts possible, experimentally at any rate, Cierva was not altogether satisfied, and felt that a different solution was possible. In conversation with the Editor of *Flight* a few weeks before his death the great inventor dropped a remark which was not only indicative of Cierva's modesty, but gave promise of a continuation of the work which he began. "If any credit is due to me over the 'autodynamic' rotor head," he said, "it is only for having sensed that somewhere the perfect solution of the location in space of the blade axes exists. The calculations entailed to verify that feeling would have taken me years, and it is the Royal Naval College, which has carried out these calculations, which should receive the credit for determining the actual locations of these axes. The work is now done, and I could retire at any moment, with the sure knowledge that others could carry out the work." In our sorrow over the loss of this brilliant engineer and inventor, we may take comfort from that thought.

Juan de la Cierva was born at Murcia, Spain, on September 21, 1895. His father was for a period Minister for War, and Juan's connection with Government circles was thus a very close one. The present troubles in Spain caused Cierva a great deal of distress, and he was very anxious concerning the future. Who knows but what it may not be a mercy that he did not live to see the final outcome of the conflict?

One of the great charms of Juan de la Cierva was his modesty. Three times he lectured to the Royal Aeronautical Society, and each time, as Mr. Wimperis recorded at Mr. Gouge's lecture last Thursday, he had real progress to record. He never promised more than he could fulfil, and he was that *very* unusual type of inventor: the man who knew more about both the theory and practice of his invention than anyone else. He had the courage of his conviction and learned to fly his own machines, not merely tolerably but extremely well. No better way of honouring his memory could be imagined than to carry to its ultimate solution the great work which he started.



WHITHER ARMAMENT?

The Cult of the "Canon" : Bigger Shells and Longer Range : Installation Problems

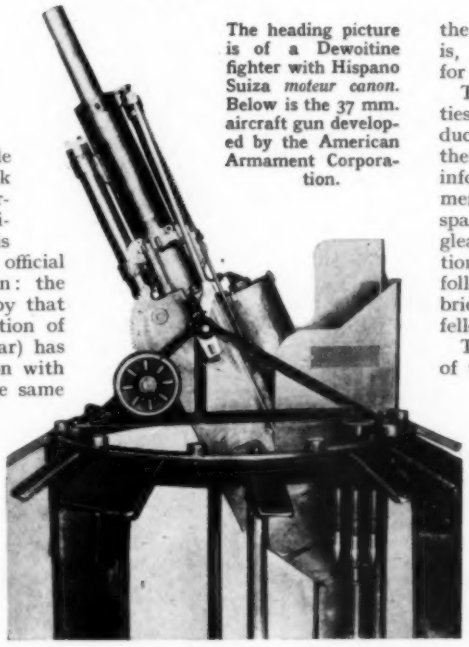
By H. F. KING

THE transitory period in the arming of our new, high-performance military aircraft might well have disturbing effects were the extent of its nebulous uncertainty more widely realised. Comment was made in a *Flight* leading article last week on the gravity of the position of aircraft armament in this country, a position of which detailed analysis is rendered impossible by a barrage of official regulations. But one thing is certain: the development of aerial gunnery (and by that term is meant especially the production of new weapons and their associated gear) has been reprehensibly slow in comparison with the momentous advances made in the same field abroad, and, for that matter, with the evolution of the military aeroplane and its power plant in Great Britain.

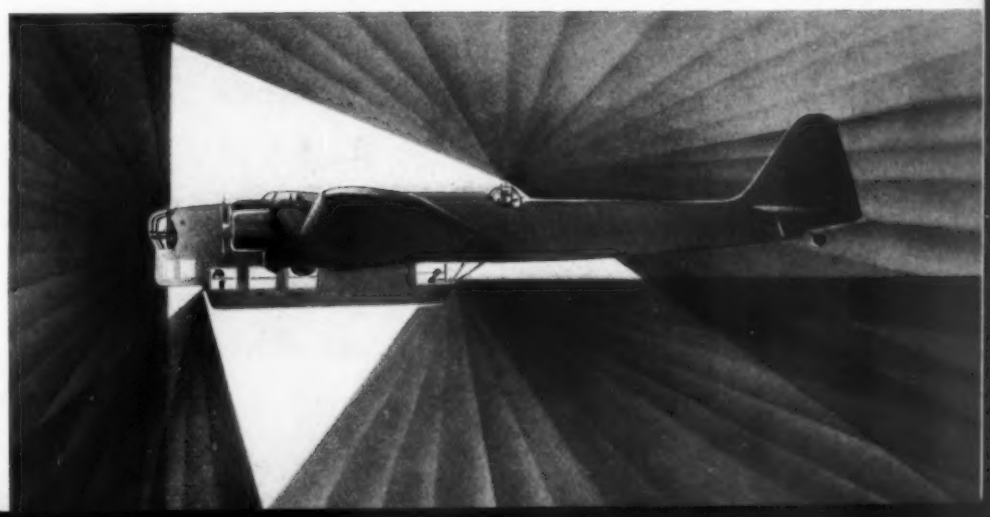
It does seem, however, that, for all our lackadaisical attitude in recent years, we now have some of our finest technical brains concentrated on the improvement of aerial ordnance. The latest results of their efforts are not being publicised, but judging from such information on their work as has been released, it seems that we are in a relatively strong position in the design of power-driven turrets, without which devices the most efficient free gun is so much dead weight on modern high-speed aeroplanes. In the matter of actual weapons there is, relatively, much greater room for improvement.

The reticence of our own authorities to issue data on recently produced armament material has had the inevitable repercussion abroad; information on the latest developments has become somewhat sparse. But sufficient can be gleaned to study the broad direction of foreign tendencies, and the following notes are intended as a brief survey of what "the other fellow" is doing.

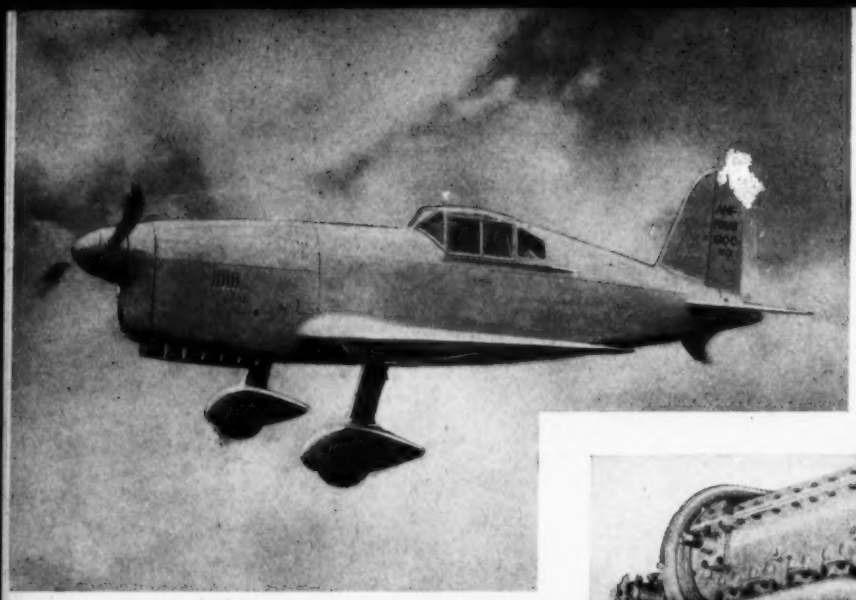
The increasingly wide adoption of the *canon*, or shell-firing aerial gun, by European powers is, all things considered, a perfectly logical move, and not, as some of our diehards would have us believe, a phase of temporary military insanity. Supposing those worthies are right, then we may soon be stricken with the same epidemic; the *canon* germ is already gaining a hold across the Atlantic.

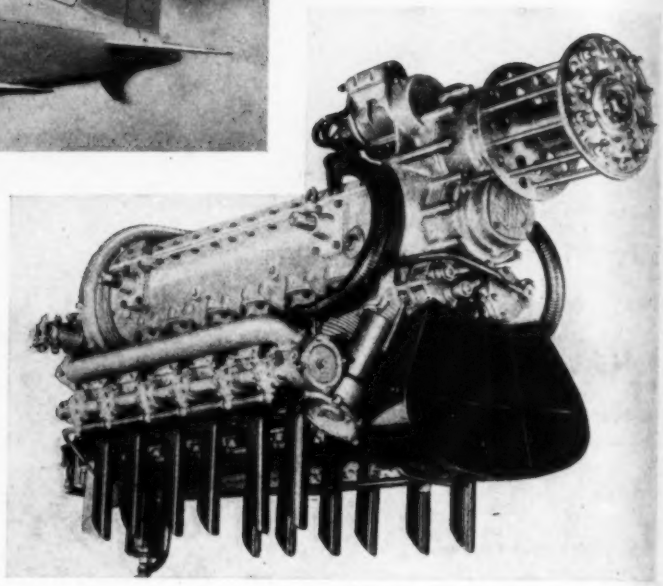


The heading picture is of a Dewoitine fighter with Hispano Suiza *moteur canon*. Below is the 37 mm. aircraft gun developed by the American Armament Corporation.



Demonstrative of the field of fire obtainable from a well-arranged multi-seater, this drawing shows the arcs covered by the guns of the French Amiot 144.





The new Mureaux 190 light single-seater fighter (above) mounts a Salmson inverted vee-twelve engine arranged to accommodate a *canon* firing through its airscrew boss, which, as will be seen on the right, is raised accordingly.

The argument for the adoption of the *canon* is by now fairly widely known, but may conveniently be reiterated at this juncture. Protagonists of the *canon* maintain that this weapon is desirable because of its greater destructive power per shot. In reply to this, the opposing school of thought maintains that a fighter carrying, say, eight high-speed machine-guns can discharge a far greater number of projectiles in a given period of time than the most highly developed *avion canon* (equipped, say, with two *canons* and two machine-guns). The *canon* exponents agree, but retaliate that the effective range of the modern rifle-calibre machine-gun is small compared with that of the *canon*, and that modern all-metal military aeroplanes are so constructed that they can be literally riddled with rifle-calibre bullets without being destroyed.

It seems, in fact, that the day of the lead-spraying fighter, if not over, is fast waning, and that the seemingly inevitable passing of the dog-fight may mark the extinction of the rifle-calibre machine-gun for aerial fighting. And so the theory that aerial warfare will be conducted more and more after naval teachings and that aeroplanes will strive to out-range each other and to triumph by sheer power of armament is fast gaining hold.

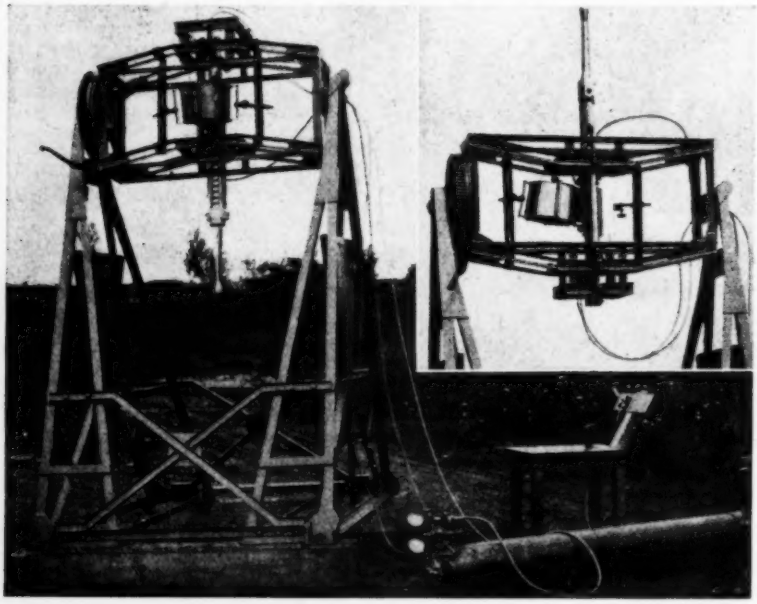
Having flown temporarily into the grim future, let us review the situation to-day. How efficient are modern *canons*, and how are they being applied to modern aircraft?

Let it be clearly understood that the small-bore *canon* is actually in production as *standard equipment* of certain air services. France has ordered the Dewoitine D.510 monoplane armed with one 20 mm. *canon* and two machine-guns, while Turkey and Poland have accepted the Polish P.Z.L. P.24, which can carry two 20 mm. *canons* and the two customary machine-guns. Admittedly, it does seem that not all Turkey's P.24s will be *canon* machines.

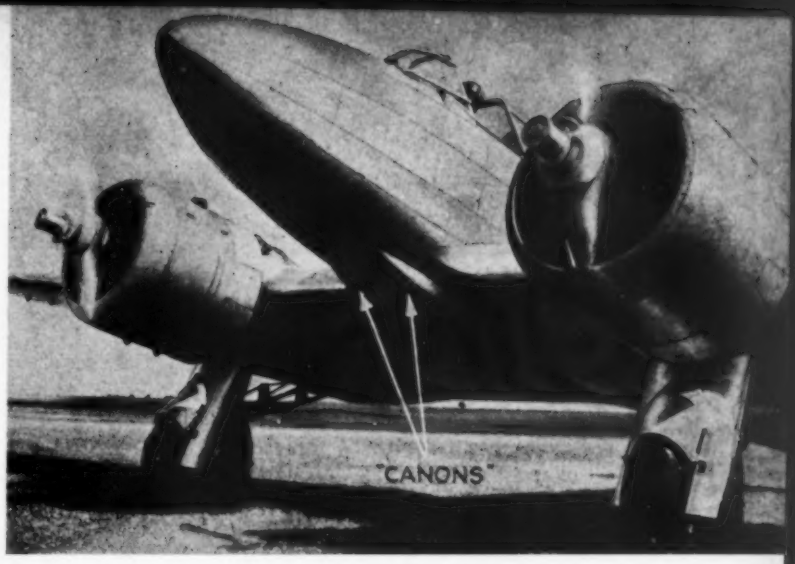
So far the *canon* has been applied almost exclusively to fighters whose guns are fixed, there being, as may well be imagined, far greater difficulties if a free installation is attempted. The fixed installation is governed by the type of engine installed; should it be of in-line design it may be possible to arrange a *canon* to fire through the airscrew hub, after the fashion originated by the Hispano-Suiza company and more recently adopted by Farman, Salmson and Walter, but if a radial engine is specified it becomes necessary to place the weapons in the wings or fuselage, whence they shoot clear of the airscrew arc.

The only *moteur canon* at present in quantity production is the Hispano (Series X of 690 h.p. and 860 h.p., Series Y), although before long, if the comparatively low-powered single-seater fighter finds continued encouragement, we may see the adoption of the 450 h.p. Salmson inverted vee-twelve.

Hispanos mount their 20 mm. shell-



A stand for testing the Oerlikon FF *canon* at various angles of elevation and depression.



Two *canons* are mounted in fairings below the fuselage of the new Potez 63 three-seater, twin-engined fighter.

firing gun on the top half of the crank case between the two banks of cylinders. This demands a modification of the reduction gear, the distance between the centres of the spur wheels being increased. Since this combination was revived two or three years ago (René Fonck used a Spad with an Hispano *moteur canon* during the war) the gun has continually been improved, and the latest figures for its performance are elusive. The gun itself weighs just over 100 lb. and a magazine containing sixty rounds of ammunition another 60 lb. A muzzle velocity of about 2,900 ft./min. is claimed for the projectiles, which may be of explosive, incendiary, tracer or armour-piercing variety. The rate of fire is said to be about 400 rounds a minute.

Overheating and vibration are two of the factors which manufacturers of radial engines frequently quote as militating against the efficiency of the *canon* engine, although it seems that these considerations are not so serious as is commonly believed. A more telling argument would be the fact that only one gun can be incorporated in such an engine and that, as more weapons will undoubtedly be required, why should they not be mounted in the wings or fuselage, avoiding complication of the power plant, already delicate and intricate?

When a *canon* is applied to an inverted engine like the Salmson or Walter vee-twelve it immediately increases the depth of the complete installation and detracts from the view obtainable over the cowling, the comparative merit of which is one of the benefits attendant on the use of an inverted engine.

It seems somewhat strange that no one has yet combined a *moteur canon* installation with a pair of outboard *canons*, although machine-guns shooting clear of the airscrew arc are usual in a *canon*-engined machine. A number of Continental radial-engined single-seaters carry a *canon* in each wing, and unless there are insuperable structural difficulties, which does not seem likely, one must deduce that the weight of a triple installation would have proved excessive or that the cause was professional rivalry between the manufacturers of radials (advocates of the outboard *canon*) and producers of *moteurs canons*.

The three best-known machines fitted with outboard *canons* are the Polish P.Z.L. P.24 and the French low-wing and high-gull-wing Loire models.

In a typical installation the guns are mounted on a framework inside the wing between the spars, projecting portions being provided with appropriate fairings. A removable panel permits cleaning and adjustment of the weapons and a second door the insertion of the cylindrical magazine.

Levers in the pilot's cockpit effect the loading of the first round for each, and two press-buttons on the control column are arranged—one to fire the guns (pneumatically) and the other to control the safety catches. The sights are of normal type.

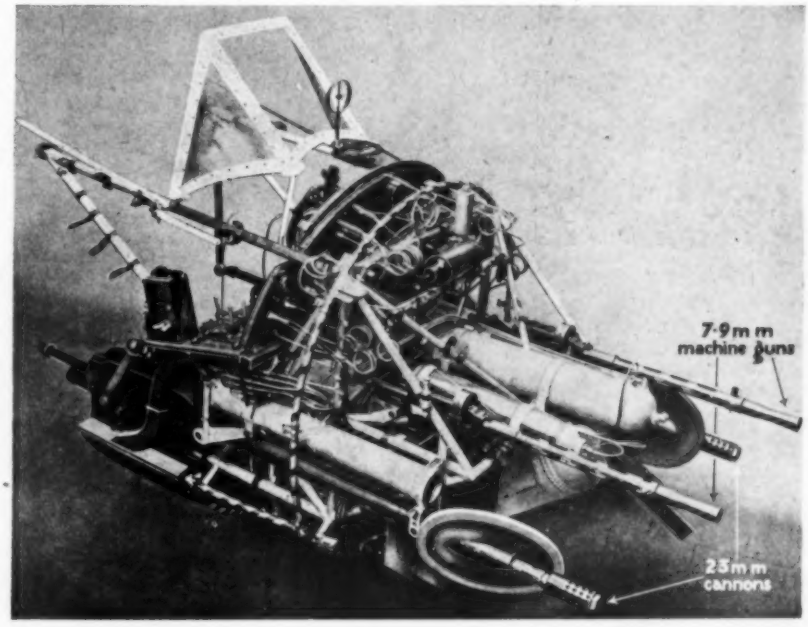
In the air, the recoil force of the two guns (about 465 lb.) is said scarcely to be felt, which can be understood when it is realised that the aircraft, virtually a flying gun-carriage weighing, say, 4,000 lb., is travelling at about 330 ft./sec. in a direction opposite to the recoil. When he ceases firing the pilot experiences a slight forward acceleration.

Another claim is that when a *canon* stops firing through a misfire or jamb there is no appreciable influence on the flight path of the machine.

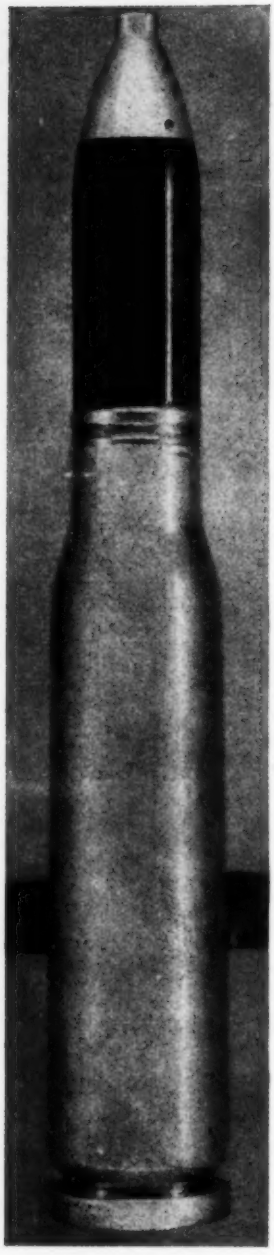
"Canons" in the Fuselage

Some of the very newest twin-engined fighters and attack machines (*e.g.*, the Fokker G.1, Potez 63 and Hanriot 220, exhibited at this year's Grand Salon) mount groups of *canons* actually in the fuselage. Whereas the Potez and Hanriot fit the guns in the fuselage flooring, Fokker places them in the nose portion. The armament of the G.1 is actually of quite unusual interest and deserving of fairly detailed description.

The pilot of the G.1 is provided with two 23 mm. Madsen automatic *canons* and two Madsen machine guns of 7.9 mm. calibre. Great advantages are claimed for the 23 mm. gun as compared with one of 20 mm. calibre; although of approximately the same weight it is said to be capable of firing shells with double the explosive power. By carrying the shells in belts it has been possible to



An excellent view of the nose portion of the Fokker G.1 twin-engined attack machine, showing the installation of the *canons* and machine guns.



The word *canon* conveys to the layman the impression of some mighty piece of ordnance; the left-hand view shows, actual size, a shell for a 20 mm. Madsen. On the right are gathered together the fragments of an exploded projectile.

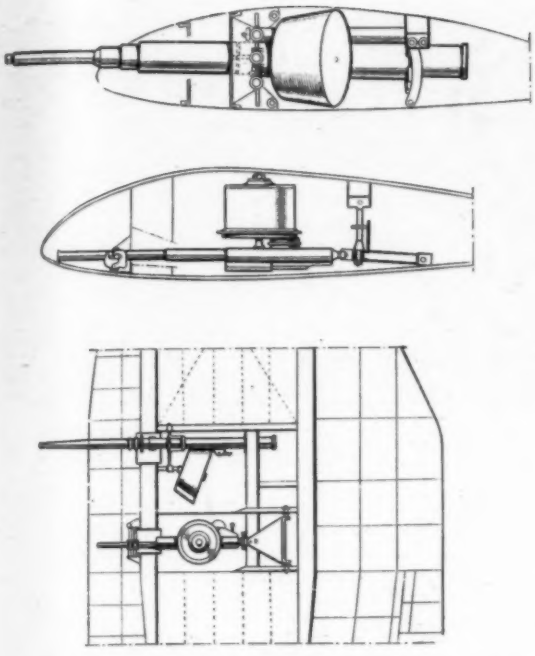
accommodate a hundred or more rounds for each gun, which can fire at the rate of 400 rounds a minute. The highly sensitive fuse of each shell is arranged to cause explosion ten seconds after discharge should the projectile miss its target.

The four guns can be used singly or in various combinations, and are loaded and fired by a combined pneumatic and hydraulic system. The machine guns are mounted well forward in the nose, the *canons* being placed farther aft so that their breeches are in the pilot's cockpit.

An unusually interesting installation also features in the rear gunner's position on the G.1. This takes the form of a conical turret of "Plexiglass" which preserves the streamline shape of the fuselage remarkably well. The turret contains a 7.9 mm. Madsen gun and can make a complete revolution on an axis in the direction of the line of flight. When he wishes to fire, the observer passes the barrel of the gun outboard through a slot which is closed again when the gun is withdrawn.

But to revert to *canons*. One of the most advanced forms of shell-firing gun has been developed, not on the Continent, but in the United States by the American Armament Corporation, represented in this country by W. S. Shackleton, Ltd., 175, Piccadilly, W.1.

The A.A.C. *canon* is of 37 mm. calibre, or the same bore as the large guns installed at one time in certain of our Blackburn Perth flying boats. Another weapon of this calibre was mounted experimentally in an old Westland intercepter fighter monoplane, being placed in the fuselage and firing upward and forward.



Showing the installation of a drum-fed machine gun and 20mm. *canon* in the French Loire 46 fighter.

The A.A.C. 37 mm. aircraft gun is an automatic weapon available in two forms: the type M (movable) is a 20-calibre model, whereas the type F (fixed) is a 50-calibre type.

Intended for use on large machines to protect them against the attacks of fighters, the former is mounted in a nose or fuselage turret with a plastacele protective dome, being capable of 360 degrees traverse, 15 degrees depression, and 60 degrees elevation. The gun is traversed by a wheel at the gunner's right hand, and elevation is effected by a second wheel on the opposite side. The gunner has a seat which rotates with the gun, and he is provided with a right-angle sight which remains fixed in relation to his eye in any position of the gun. The traversing brake is worked by the gunner's right foot and the firing trigger by his left.

Clips containing five rounds of ammunition are used and the firing mechanism may be set at "safe," "single shot" or "full automatic." It is impossible to fire the last shot of a clip until a new magazine is inserted or the gunner intentionally fires the remaining round; thus the only break in the continuous fire of the weapon is the time required to change clips.

A thermostatically controlled electric heater may be fitted around the hydraulic cylinder of the gun to maintain constant temperature, regardless of altitude or weather.

It is claimed that the recoil force is less than 1,000 lb., and that the complete installation weighs 250 lb. The muzzle velocity is 1,250 ft./min. (it should be remembered that the gun is only 20 calibre in length) and the rate of fire 100 rounds a minute. The possibilities of a gun with a higher muzzle velocity have been studied, but it was decided that, in view of the fact that for some years aerial engagements are likely to be held at comparatively close range, the tremendous increase in weight and size was not worth while.

The A.A.C. 50-calibre type F aircraft gun is simply an enlargement of the type M weapon and is essentially an offensive weapon for mounting in the nose of a multi-engined machine. Firing is done electrically by the pilot, while a second member of the crew changes magazines. The muzzle velocity is 2,700 ft./sec., and the rate of fire 90 rounds a minute.

Five of the leading American aircraft manufacturers have made provision in the new aircraft types for the installation of A.A.C. guns, and in this country these weapons are being specified on Burnelli type aircraft built by the Scottish Aircraft and Engineering Co.

The manufacturers maintain that no explosive shell smaller than 37 mm. bore and equipped with a thoroughly modern fuse, day and night tracer and delay-action arrangement can be made bore-safe and absolutely detonator safe. It is impossible, they claim, for one of their shells, which are loaded with cast T.N.T., to explode prematurely while in the gun. Arrangements have been made so that the explosive charge is detonated after the tracer has completed its burning.

However perfect an aircraft gun, be it a *canon* or a machine gun, it is useless without an efficient mounting, and to-day the design of a mounting is probably as difficult as the design of the gun.

Power-driven mountings will henceforth be essential on multi-seater machines, and in the design of such devices Great Britain is undoubtedly ahead of the rest of the world.

A combination of powerful forces militate against the production of a completely efficient mounting. Apart from the difficulty of evolving an operating mechanism capable of functioning satisfactorily under all conditions of flight aerodynamics enter into the problem, for not only do protruding gun barrels complicate affairs, but the shape of the actual turret must be carefully considered. Retractable, or highly streamlined gun positions seem bound to come into vogue; even the retractable type must offer as little drag as possible when extended. The rear turret in the Fokker G.1, previously mentioned, and the fuselage gun positions on the four-engined Boeing bomber are excellent examples of the progress made.

Unhappily it is not possible to discuss at any length the merits of new British and foreign gun mountings. It is significant that during public appearances the gun positions on a number of our new multi-engined machines are either dummies or are screened with fabric.

Mounting Difficulties

Among the major problems to be faced to-day are those connected with the cooling of internal installations and the deflection, due to the speed of the machine, of bullets fired broadside. The latter problem will become more serious as the speed of aircraft and the effective range of guns increase, and if higher velocity has to be obtained at the expense of lengthened barrels additional complications will doubtless result.

There is little news of improvements in the design of small-bore machine guns. Outboard installations are likely to become common in this country, being facilitated, no doubt, by the use of the Browning gun. Modern cantilever wings are comparatively free from torsion and vibrations, old troubles met in outboard installations.

Present-day single-seaters lend themselves to a variety of armament installations enabling different combinations of guns to be mounted for different requirements. For example, Fokker offers the D.21 fighter with any of the following installations: one *moteur canon* (Hispano Ycrs with 20 mm. gun) and two or four machine guns (0.3 in.) in the wings; one machine gun of 0.5 in. calibre firing through the airscrew and two rifle-calibre guns in the wings; two synchronised 0.5 in. guns in the fuselage and two 0.3 in. machine guns in the wings; or two 20 mm. *canons* in the wings and two rifle-calibre machine guns in the fuselage. The French Dewoitine D.373 is supplied with four or six machine guns (the former armament is specified for this machine by the French Navy, and the latter by the Lithuanian Government); two 20 mm. *canons* and two machine guns; or one Hotchkiss high-velocity 25 mm. *canon* and two machine guns.

The immediate future will doubtless see intensive development work with *canons* and mountings for free guns. We can only hope that the weapons which will be required to equip our naissant military aeroplanes will be as highly developed as the machines.

Topics of the Day

Indefinite Variety

IF there is one person in this world whose place I should hate to take it is the man whose job it is to decide on the type of aeroplane which is most likely to appeal to the greatest number of private pilots. Prospective owners are so very fussy and intolerant and have so often asked for something which, when produced, they have not wanted.

The enormous variation to be seen in ultra-light design and layout should be enough to frighten anyone who proposed to put his shirt on any particular machine, and even the full-size light aeroplane manufacturers must find it difficult to make up their minds. Can they be blamed for producing stick and wire models one at a time? Only the makers of military machines and Mr. Douglas, of America, have so far seen their way to go in for mass production in metal—yet the "all-tin" aeroplane is more likely than any other to find favour in the eyes of the car-minded prospective owner.

In the ultra-light section there do, however, appear to be three likely layouts. One is the comparatively slow side-by-side cabin machine with useful luggage accommodation and a good range—for those pilots who cannot afford to buy and run a full-size machine, yet who want to get as near to this as possible. Another is the pure plaything which can, nevertheless, be used seriously by a man or woman to whom time and distance are unimportant terms. This is likely to be of the pusher type with a low wing-loading and of simple construction.

Thirdly, there is the cleaned-up low-powered machine with an extremely good performance for the serious-minded singleton sporting pilot who has learnt to fly properly and who is prepared to deal with the flattest of flat glides and a long-period hold-off. He cannot have flaps without reducing the payload or range, and if he demands comfort the price will go up; cleanliness, anyway, costs money. The market for such a type will be comparatively small, but it should be quite steady.

Pleasing Everybody . . .

AS I have already remarked, even the manufacturer of the full-size machine is hardly in a better position unless he can produce something with outstanding characteristics at a very low figure.

If I had to make up my mind I should go nap on accommodation, good visibility, a short take-off, a good range, and a low landing speed—though not so low as to make the machine difficult or impossible in high winds; 40-45 m.p.h. is quite low enough provided there is ample control and that the approach angle is steep.

Speed, above a certain basic minimum (say 100 m.p.h.) would take a poor sixth place. Boring though it can be to make long cross-country flights over uninteresting country in a slow machine, real speed usually brings disadvantages in its train, and the average amateur is neither experienced nor keen enough to demand speed at the cost, for instance, of a poor take-off and discomfort. Fast machines will always be marketable, but the mass-production manufacturer (if there ever is such a person) will not need to worry too much about it.

His client will demand the sort of spaciousness, both for himself, his passenger and his luggage, that is provided in his car; he will expect to be able to see out properly; and he will want to be able to use *all* aerodromes and landing fields with safety while carrying a carelessly disposed full load. A big range will give him a second chance if his destination proves to be climatically impossible, will allow him to fly against headwinds without continuous worry concerning suitable refuelling points on or near his route, and will make Continental, or extra-Continental, touring both possible and pleasant.

. . . Or Nobody

WHEN it comes to detail arrangements I should find it very difficult to make up my mind. Much as I like the side-by-side arrangement, there are times when it can be a very thorough nuisance.

In bad weather, or while making an approach into a crowded aerodrome, it is very nice to be able to see on both sides without stretching and at virtually the same instant; things happen quickly in the air. A passenger who knows nothing whatever can be more of a help than a hindrance when you are worrying over maps and landmarks during a bad-weather cross-country flight.

Finally, there *are* passengers who, for various reasons, one wishes to keep in the background during a long journey. No one is so confidence-destroying as a talkative passenger possessed of the little knowledge that is so dangerous, and many nervous pilots prefer that "solo" feeling. However, a good deal more than half the trouble is the psychological result of being trained in tandem-seaters, and a pilot who was brought up in a side-by-side cabin trainer should be thoroughly accustomed to the feel of an elbow at his or her side—unless, of course, the elbow is part of a very stout person who spreads all over the cabin; that is irritating in the extreme, whether one is driving a car or flying an aeroplane.

But even as I was deciding to give the pilot a single seat in front I should remember how helpful a passenger may be; how painful to the neck and larynx it can be to converse with a passenger lounging yards behind; and how pleasant it is to talk in comfort during a dull cross-country. Furthermore, when flying alone, the empty seat forms a useful table for maps and oddments, and the advantages of side-by-side instruction at least outweigh any disadvantages—and these are usually invented by the conservative instructor.

INDICATOR.

FROM the CLUBS

Events and Activity at the Clubs and Schools

REDHILL

FLYING time for the week ended December 11 amounted to 22 hr. 10 min. The Club's annual turkey supper and cinema show will be held on Saturday, December 19.

YEADON

Club aircraft flew 9 hr. 40 min. during the week, and Mr. J. F. Heaton, of Leeds, an Aviation Group member, made his first solo flight.

CAMBRIDGE

Flying times at Marshalls' Flying School for the week ended December 13 totalled 17 hr. 15 min. A dense fog which lasted most of the week prevented more flying.

CROYDON

Club members flew 30 hr. 20 min. last week. Mr. F. W. Brown has completed his "A" licence tests, while Mr. R. F. Graesser is having dual on the Club's Dragonfly. Mr. R. Pierce and Mr. P. Hahn returned from Plymouth on Friday, where they have been held up by fog. Four new members have been enrolled.

BRISTOL AND WESSEX

Flying times for November amounted to 30 hr. 40 min., while those for the fortnight ended December 12 totalled 22 hr. 10 min. New members are Miss M. Baldwin, Messrs. G. H. James, A. H. Townsend, J. A. Richards, J. H. Hickman, Dr. Harvey Nichol, the Rev. Peter Hemming, and Capt. D. C. E. Grose. The Club will be closed on Christmas Eve, Christmas Day and Boxing Day, opening again on Sunday, December 27.

MIDLAND

For the week ended December 11 flying times totalled 4 hr. 10 min. dual and 3 hr. 10 min. solo and passenger. Messrs. C. Apperson and A. C. Edwards have gone solo and a cross-country flight to Desford was made. The Club will be closed from mid-day on Thursday, December 24, until the morning of Monday, December 28, but both petrol and oil will be available between those dates for visiting machines and private owners.

YAPTON

Flying times for November reached a total of 58 hr. 55 min., but for December, to the 11th, only 10 hr. 5 min. were logged owing to the extremely bad weather. New members are Mr. Anthony Stuart, who has signed the £15 contract for his "A" licence, and Mr. R. N. Hill, who is taking an "A" licence with the intention of continuing for his "B" later on. Mr. John Hunter has passed his "B" licence tests and Mr. S. S. Coleman will commence training for his in January.

LEICESTERSHIRE

Flying activities were very much restricted by the bad weather which prevailed during November, the total being 30 hr. 50 min. Ten cross-country trips to six different aerodromes were made, and eighteen aircraft of various types visited the Club during the month. Another successful dance was held in the clubhouse on November 27. A deputation of the Derby Corporation visited the airport on December 26 and were conducted round the hangars and airport buildings by Mr. A. T. Gooseman, the City Surveyor and other officials of the Leicester Corporation. After their tour of inspection they had lunch at the Club.

LONDON

Bad weather brought down the flying time last week to 27 hr. 30 min.

NORFOLK AND NORWICH

The Club's latest prospectus entitled *The Norfolk and Norwich Aero Club's Summer and Winter Scheme* has been posted all over the world and weekly enquiries are received from India, Africa and other Colonies. This is an attempt on the part of the Club to make overseas visitors air-minded and also, of course, to attract them to Norwich.

CINQUE PORTS

More foggy weather during the week has had the usual adverse effect on flying hours. Mr. Da Port and Mr. Morris, who flew up to Hanworth last Thursday, had to land in a small field near Sevenoaks on Friday afternoon owing to increasing fog and cloud on the way back. They flew over in the Club Tiger Moth on Saturday morning to collect the machine, in spite of the fact that conditions showed very little improvement on those of Friday afternoon. Mr. and Mrs. W. E. Davis left for Bournemouth, where the former hopes to complete his convalescence.

YORKSHIRE AVIATION

Bad weather and fog have again been instrumental in bringing down flying times, but Mr. Lord succeeded in concluding his tests for his "A" licence. A dance was held in the clubhouse on Friday, December 4, and was well attended. The next dance will be held on January 15. The flying school will be closed at both York and Leeming on Thursday, December 24, Christmas Day and Boxing Day. The Club at York will be closed on Christmas Day, but will be open as usual for the rest of the holidays. A members' lunch will be held on Sunday, December 27, from 12 o'clock onwards.

BROOKLANDS

Unsettled weather has again lowered the flying hours this week. Miss D'Anacker and Mr. Reid have gone solo, and Mr. Dunphy is doing four hours' training on the Tiger. New members include Mr. Rosewarne. High winds prevailed at Brooklands on Sunday, December 6, so pupils were taken down to Shoreham for instruction. Visitors to the aerodrome during the week were Sir Philip Sassoon, who picked up Air Marshal Sir Cyril Newall in his Dragonfly. Lord Suirdale has joined the ranks of private owners. The annual Tramps' Party in the clubhouse on Saturday, December 12, achieved more than usual success and members thoroughly enjoyed each other's state of raggedness in the "Casual Ward" of the Club premises.

KARACHI

Members of the Karachi Aero Club put in 206 hr. 10 min. during the month of October. The Club was honoured by the presence of His Excellency the Governor of Sind and Lady Graham, who were taken for flights over Karachi by Major Jones in the Leopard Moth. Training in all departments continues as usual and the benefits of the recent additions to the Club's training facilities are already being felt. The new Hornet Moth has proved to be a most popular addition to the Club's fleet. Cross-country flights during the month were carried out to Gwadur, Jodhpur and Hyderabad. The new landing ground at Moghul Bhim, which has just been completed, provides an alternative ground for practice cross-country flights and should prove popular.

ANOTHER INVADER: The agency for this machine, the American Porterfield 70, has been obtained by Surrey Flying Services. With a 70 h.p. Le Blond engine this tandem-seater cabin monoplane cruises at 105 m.p.h. and will cost £625 over here.

Private Flying

NORTHAMPTONSHIRE

Flying hours have been very low at the Northamptonshire Aero Club owing to the consistent fogs at Sywell. Forthcoming events include a Buffet Dance on December 18 and a dance on New Year's Eve. The Club will close on Christmas Day and Boxing Day, and for flying from December 25 to January 1.

WITNEY AND OXFORD

Owing to adverse weather conditions under 30 hours were flown by the Witney and Oxford Aero Club during November. New members are: Major Eric Crossley, Messrs. E. D. Nicol (who has joined to take his "B"), C. W. F. Carter, W. W. Oakley and R. W. Lucie-Smith, while Messrs. E. D. Nicol and A. D. Morton are taking the wireless course.

COTSWOLD GLIDING

The inaugural meeting of the Cotswold Gliding Club was held recently at Burford. The Club is purchasing a Dickson training machine and hopes to draw members from Cheltenham, Cirencester, Swindon, Oxford, Banbury and the surrounding districts. Several sites have been inspected, and the Club intends to start flying early in the new year. Full details may be obtained from the Hon. Secretary, Mr. D. J. Pether, of Culver's Close, Burford, Oxon.

BORDER

No flying has been possible this month until Sunday, December 8, when 7 hr. 45 min. were flown in three machines. Visitors were Mr. Neilan, in Lord Londonderry's new Monospar, Mr. Mackay in a Fox Moth, and F/O. Robinson in a Royal Air Force Lynx Avro. The latter pilot hoped to reach Glasgow the same day, but ran into a very bad snowstorm and had to return for the night after being forced down near the Solway Firth. Cross-country flights have been made to Newcastle and Leeming.

C.A.S.C.

In spite of poor visibility flying was possible on Sunday between 11.30 and 2.30, during which time members flew 4 hr. 30 min.

SOUTHEND

Continuous fog has grounded machines during the week, but during Sunday it cleared and the Club was able to enjoy some of its usual activity. On Saturday, December 12, the Club held a dinner, concert and dance, the first of its kind, but, judging by its success, it will not be the last.

A.S.T.

Air Service Training has been well in the news during the past month in connection with the marine training of Imperial Airways personnel. November has seen the arrival of a number of new students from overseas. Amongst them were Mr. Sahni of India and Mr. Maignan of Haiti, for the Long Course; Tungku (Prince) Ahmad, son of H.H. the Sultan of Selangor, who joined for a short military course; Mr. Hissy, for a course prior to entering the R.A.F.; First Officer Hazek, of Misr Airwork, Egypt, for a short course of flying on multi-engined aircraft; and Mr. Papps. Capt. Murdoch, of South Africa, returned and completed his training, and Mr. Dhawan, an ex-A.S.T. student now employed with Indian Transcontinental Airways, returned from the navigators' and wireless courses. Mr. Henze, of Austria, and Mr. Whateley left on obtaining their "B" pilot's licences, and Mr. Kathuria, who obtained the ground engineers' "A," "C," "D," and "X" licences, and the P.M.G.'s W/T air operators' licence, left to take up an appointment as aircraft inspector. Mr. Hamdi has also returned to Egypt.

The number of hours flown during the month was 1,069 and the results of the wireless courses during 1936 have been particularly gratifying. Nine out of ten candidates qualified for the W/T air operators' licence with an average percentage of 90.35 marks.

Economics at Eastbourne

THE proposed rally and garden party at Wilmington, which had been planned as part of the Eastbourne Coronation celebrations has been turned down by the Council on the score of its cost to the borough—the not inconsiderable sum of £550. The rally was, however, planned on a scale which might have done justice to Eastbourne.

Big Beginnings at Birkenhead

WITH Lord Leverhulme as its first president, it would seem that the recently formed Birkenhead Flying Club might well prosper. In fact, at a dinner given by the club in his honour on December 8, Lord Leverhulme promised a substantial sum if the club itself could show a credit balance of £100 towards its first machine. The toast of "The President" was proposed by Capt. H. I. Hughes, the chairman of the club. Among those present was the Mayor of Birkenhead (Mr. Oscar Prentice), Viscount Tiverton, Mr. W. F. Davison, of Merseyside Airport, Ltd., Mr. Hugh Lewis, J.P., and the Chief Constable of Birkenhead (Capt. A. C. Dawson).

Solo Adventure

"High Failure," by John Grierson. William Hodge and Co., Ltd., London, 12s. 6d. net.

IN this perhaps too modestly titled book Mr. Grierson tells the story of his noteworthy 1934 flight from London to New York *via* Iceland, Greenland, Baffin Land and Canada.

In the early chapters he confesses most entertainingly how he failed to reconcile nimself with the Service career which he had chosen. His resignation was refused, so he smuggled himself—he was stationed in India—into his Moth *Rouge et Noir*, and flew home, making long hops to avoid R.A.F. aerodromes. The business was settled in the end without a court-martial, though not without a period of open arrest.

Next came a solo flight of 9,000 miles round Russia, and then an abortive attempt on the Arctic air route in *Rouge et Noir* equipped as a seaplane; a nose-over into a choppy sea at Reykjavik put paid to the attempt.

Rebuilt, and fitted with wheels and ski equipment, the little Moth finally carried Mr. Grierson round Eastern Europe in mid-winter. In 1934 he took delivery of a Fox Moth seaplane, *Robert Bruce*, and his adventurous flight over that formidable frozen desert, the Greenland Ice Cap, forms the major part of the book.

During much of his flying he was carrying out experimental and demonstration D/F work for Marconis, and his observations on the behaviour of homing equipment add interest to the story.

Full-Scale Performance

ON December 5, which, it may be remembered, was a particularly unpleasant day, a Tipsy monoplane was flown non-stop by Flt. Lt. F. H. Dixon, from Heathmoor, Mddx., to Whitchurch, Bristol.

There was a wind of 59 m.p.h. at 1,000ft. blowing from the W.N.W.—virtually dead ahead—yet the journey was made in exactly two hours, indicating a cruising speed of 90 m.p.h. The landing at Whitchurch apparently presented little difficulty.

Forthcoming Events

December 17. R.Ae.S. Lecture*: "Profile Drag," by Prof. Melville Jones.
December 17. R.Ae.S. (Coventry Branch) Lecture: "The Queer Side of Flying," by Capt. Laurence Pritchard. Armstrong Siddeley Canteen, 8.15 p.m.
December 18. London Aeroplane Club: Dinner and Dance, Park Lane Hotel, London.
December 18. Leicestershire Aero Club. Christmas Fancy-dress Dance, Clubhouse, 8.30 p.m.

1937

January 8. R.Ae.S., I.P.T. and I.A.E. Joint Lecture: "High-duty Aero Engines and Fuels," by Mr. F. R. Banks. Royal Society of Arts, 5.30 p.m.
January 14. R.Ae.S. Lecture*: "Magnesium Alloys," by Dr. C. H. Desch.
January 20-22. Aerodrome Owners' Association: Airports Exhibition and Conference.
January 28. R.Ae.S. Lecture*: "Plastic Materials," by Dr. N. A. de Bruyne.
February 3. Royal United Service Institution Lecture: "The Anti-Aircraft Defence of Great Britain," by Maj.-Gen. R. H. D. Thompson.
February 5. Cinque Ports Flying Club: Annual Dinner and Dance.
February 10. Yorkshire Aviation Services Annual Dinner and Ball, 8 p.m., Grand Hotel, Harrogate.
February 11. R.Ae.S. Lecture*: "The Automatic Pilot," by Mr. F. W. Meredith and Mr. P. A. Cooke.
February 12. De Havilland Technical School Annual Dance, 9 p.m., Hyde Park Hotel, London, W.1.
February 17. Royal United Service Institution Lecture: "Air Force Co-operation in Policing the Empire," by Air Comdr. C. F. A. Portal.
February 18. R.Ae.S. Lecture*: "Possible Layouts for Air-cooled Engines," by Mr. A. H. R. Fedden.
February 18. Civil Aviation Service Corps Dance, First Avenue Hotel, London.
February 25. R.Ae.S. Lecture*: "Power Measurements in the Air," by Mr. N. S. Muir.
February 26. Brooklands and Associated Clubs: Dinner and Dance, May Fair Hotel, London.
February 26. Hampshire Aeroplane Club: Annual Dinner and Dance, South-western Hotel, Southampton.
March 11. R.Ae.S. Lecture*: "Airscrew Blade Vibration," by Major B. C. Carter.
April 8. R.Ae.S. Lecture*: "Control Problems," by Mr. A. G. Pugsley.
April 22. R.Ae.S. Lecture*: "Power Plant Trends," by Mr. G. J. Mead.

* These lectures take place at the Royal Society of Arts, 18, John St., London, W.C.2, at 6.30 p.m. Admission is by ticket obtainable through a member.

THE ROYAL AIR FORCE

SERVICE NOTES AND NEWS — AIR MINISTRY ANNOUNCEMENTS

King George VI and Queen Elizabeth, L.G., as the Duke and Duchess of York, at the R.A.F. Display in 1924.

THE KING'S MESSAGE TO THE ROYAL AIR FORCE

The following gracious message was received last week by the Secretary of State for Air from His Majesty the King and has been notified to all Air Force Commands:

"ON my accession to the Throne, I hasten to assure the Air Forces at home and overseas that I look forward to the maintenance of my close connection with them, which has been such a happy feature of my life ever since I became a junior officer in the Service in 1918, and served with the 'Independent' Air Force in France.

"As Air Chief Marshal, I have watched with keen appreciation the way in which the Service has proved more than equal to the many tasks which a rapid expansion has imposed upon it.

"I know full well that the Air Forces of the Empire will maintain to the full the great traditions that they have already established, combining with the highest efficiency and zeal a fine chivalry of service and a deep and steadfast loyalty.

(Signed) GEORGE R.I."

12th December, 1936.

AN AERODROME IN KENYA

A new Royal Air Force aerodrome is to be built at Nairobi.

NOMENCLATURE OF AIRCRAFT

The name of the Handley Page heavy bomber aeroplane fitted (i) with Pegasus X engines is Harrow I, and (ii) with Pegasus XX engines is Harrow II.

The name of the Handley Page medium bomber with two Pegasus engines is Hampden.

No. 7 FLYING TRAINING SCHOOL, PETERBOROUGH

The undermentioned officers have been awarded special assessments as shown hereunder, on completion of a course of flying training at No. 7 Flying Training School, Peterborough:—

Distinguished Pass.

P/O.s J. W. Dallamore and J. A. G. Gordon, A.P/O. J. H. McMichael.

ANOTHER NEW SQUADRON

No. 114 (Bomber) Squadron formed at Wyton on December 1. The unit is being equipped with medium bomber type of aircraft and has been placed under the command of the A.O. C.-in-C., Bomber Command, in No. 3 (Bomber) Group.

MOVES OF SQUADRONS

No. 4 (Army Co-operation) Squadron will move from Farnborough to Odiham on February 9, 1937..

No. 13 (Army Co-operation) Squadron will move from Old Sarum to Odiham on February 9, 1937.

No. 107 (Bomber) Squadron will move from Andover to Old Sarum on February 16, 1937, and will remain in No. 2 (Bomber) Group.

R.A.F. BENEVOLENT FUND

The fifth Council meeting of the year was held at Iddesleigh House on December 9. The Viscount Wakefield of Hythe was in the chair.

The meeting was opened by the chairman with a reference to the loss sustained by the Fund in the recent death of Mr. Walter S. Field.

Dame Helen Gwynne-Vaughan, the Deputy Chairman, then read a letter received from the Viscount Wakefield of Hythe making a gift of £10,000 to the Royal Air Force Benevolent Fund. Lord Wakefield had written to say that he had in mind the establishment of a fund more particularly for the benefit of the younger generation. It would give him great pleasure to know that the income from the endowment would be used for assisting Wakefield Scholars by the awarding of educational grants, or grants for maintenance during continued education, and that these grants would be particularly directed towards the technical or higher education of promising boys or girls, the sons or daughters of officers or airmen, within the discretion of the Council of the Fund.

Air Comdre. B. C. H. Drew was unanimously elected as Honorary Treasurer as successor to the late Mr. Walter S. Field.

The total expenditure on relief for the Council year ending December 1, amounts to £18,847 16s. 10d., exceeding the figure for 1935 by over £500.

ROYAL AIR FORCE GAZETTE

London Gazette, December 7, 1936

Royal Air Force

General Duties Branch

Pilot Officers on probation confirmed in rank on dates stated: P. J. H. Harrington and J. H. Sindall, October 7, 1936; F. Holman, October 16, 1936; G. I. L. Corder, J. L. Crisp and J. W. S. Forbes, October 21, 1936; G. R. H. Black, October 24, 1936; K. E. Kennedy, November 4, 1936.

Acting Pilot Officers on probation confirmed in rank and graded as Pilot Officers on dates stated: G. B. Andrews, J. L. Atkinson, J. Barrett, D. R. Biggs, J. B. Burnett, L. R. Field, J. Foulsham, P. A. Gilchrist, H. D. Green, P. P. Hanks, F. Harrison, P. W. Hartley, G. L. B. Hull, T. M. Hunt, E. G. Jones, C. E. Levitt, W. M. Penman, C. L. C. Roberts, W. O. L. Smith, R. N. Todd-White, A. E. Williamson, D. B. M. Wright, R. P. S. Wyrill, October 7, 1936. N. A. F. Cheesman, J. Compton, P. E. G. G. Connolly, M. W. Donaldson, G. D. Evers, T. E. J. Fitton, H. J. Garlick, A. R. L. Griffiths, N. D. Gruthrie, J. H. Irvin, D. Kain, W. G. Lockhart, H. C. Maudslay, D. I. McLeod, J. P. Owens, L. V. E. Petley, A. V. Rogers, J. E. J. Sing, J. P. S. Smyth, F. W. Thomas, A. C. R. Thompson, Y. P. Wilson, A. L. Womersley, October 21, 1936. L. E. Abel, R. H. Adams, F. D. Beales, R. Bickford, G. K. Buckingham, D. H. Burnside, V. S. Butler, R. B. Carr, K. C. Doran, A. G. Duguid, A. J. Elliott, H. M. Hammond, C. H. Heber-Percy, L. C. Jones-Bateman, M. N. McF. Kennedy, C. B. Lamb, R. D. B. MacFadden, V. R. Paterson, J. C. Richards, C. S. H. Richardson, G. A. W. Saunders, K. H. Savage, J. S. Scott, K. G. Sharp, B. S. Tomlin, W. L. Warner and J. P. M. Woolley, October 28, 1936.

Acting Pilot Officer on probation A. R. Greenaway graded as Pilot Officer on probation, August 10, 1936. Acting Pilot Officer on probation D. G. Warren graded as Pilot Officer on probation, October 7, 1936. Pilot Officers promoted to rank of Flying Officer on dates stated: W. P. Whitworth (seniority January 2, 1936), April 1, 1936; J. S. O'Brien, October 16, 1936.

Equipment Branch

Flying Officers granted permanent commissions in that rank on completion of probationary service: J. G. B. O'Hagan, September 5, 1935; C. D. P. Franklin, September 19, 1935.

Commissioned Engineer Officer

W/O. S. W. Blight granted permanent commission as Flying Officer on probation with effect from November 18, 1936, and with seniority of October 26, 1936.

ROYAL AIR FORCE RESERVE

Reserve of Air Force Officers

General Duties Branch

Following granted commissions as Pilot Officers in Class AA, December 8, 1936: C. G. B. McClure and D. G. Parnall, P/O. J. L. C. Newton transferred from Class C to Class A, October 10, 1936.

Medical Branch

F/O. H. C. Smith, M.B., Ch.B., promoted to rank of Flight Lieutenant, June 4, 1933.

AUXILIARY AIR FORCE

General Duties Branch

No. 501 (COUNTY OF GLOUCESTER) (BOMBER) SQUADRON.—A. R. Ross granted commission as Pilot Officer, September 18, 1936.

No. 504 (COUNTY OF NOTTS) (BOMBER) SQUADRON.—J. M. G. Browne granted commission as Pilot Officer, July 25, 1936.

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Group Captain.—F. E. P. Barrington, to R.A.F. Station, Calafrana, Malta; to command, vice Group Capt. R. L. G. Marix, D.S.O., 9.11.36.

Wing Commander.—B. E. Baker, D.S.O., M.C., A.F.C., to R.A.F. Station, Lympne; to command, 3.11.36.

Squadron Leaders.—J. N. D. Anderson, to R.A.F. Station, Seletar, Singapore; for Administrative duties, vice Sqn. Ldr. V. S. Parker, D.F.C., A.F.C., 25.10.36. R. N. Waite, to D.D.W.O., Dept. of A.M.S.O. Air Ministry, vice Sqn. Ldr. R. L. McK. Barbour, D.F.C., A.F.C., 24.11.36. N. A. P. Pritchett, to No. 812 (Fleet Torpedo Bomber) Squadron; to command, vice Sqn. Ldr. B. B. Caswell, 25.11.36.

Flight Lieutenants.—T. C. Dickens, to No. 45 (Bomber) Squadron, Helwan, Egypt, 16.11.36. J. A. Dixon, to No. 220 (General Reconnaissance) Squadron, Bircham Newton, 29.11.36. J. J. A. Sutton, to No. 47 (Bomber) Squadron, Khartoum, 5.12.36.

Flight Lieutenants.—F. P. Smythies, to No. 220 (General Reconnaissance) Squadron, Bircham Newton, 1.12.36. A. E. Taylor, to R.A.F. Station, Ismailia, Egypt, 9.11.36. H. G. Wheeler, to No. 1 (Indian) Group Headquarters, Peshawar, 2.11.36. C. B. Hughes, to No. 28 (A.C.) Squadron, Ambala, India, 10.11.36. D. J. Waghorn, to Aircraft Park, Lahore, India, 24.11.36.

Flying Officers.—H. M. T. Eversfield, to Aircraft Park, Lahore, India, 8.11.36. A. C. Mills, to No. 31 (A.C.) Squadron, Karachi, India, 5.11.36. P. A. McWhannell, to No. 220 (General Reconnaissance) Squadron, Bircham Newton, 29.11.36. G. A. Kitching, to No. 6 Flying Training School, Netheravon, 28.11.36.

Pilot Officers.—J. H. Creswell, G. E. Ford, H. W. A. Sheahan, P. M. Astley, W. E. Ingle, C. D. S. Smith, to No. 220 (General Reconnaissance) Squadron, Bircham Newton, 29.11.36.

Acting Pilot Officers.—R. H. Warcup, to No. 220 (General Reconnaissance) Squadron, Bircham Newton, 29.11.36. N. H. de C. Brouard, D. Perry, J. D. Stern, to No. 114 (Bomber) Squadron, Wyton, 1.12.36. J. G. W. Jones, to No. 9 Flying Training School, Thornaby, 23.11.36.

Equipment Branch

Flight Lieutenants.—R. H. Latham, to R.A.F. Station, Lympne, 3.11.36. J. W. Hustwaite, M.B.E., to R.A.F. Station, Leconfield, 3.12.36. N. E. Sharpe, M.C., R.C.A.F., to R.A.F. Station, Dishforth, 3.12.36. C. I. Fry, to R.A.F Depot, Aboukir, Egypt, 6.11.36. H. H. Hilliar, to No. 31 (A.C.) Squadron, Karachi, India, 28.10.36.

Pilot Officer.—F. G. Metcalf, to R.A.F. Station, Lympne, 3.11.36.

Accountant Branch

Flight Lieutenant.—A. W. Younghusband, to R.A.F. Station, Leconfield, 3.12.36.

Flying Officers.—P. Griffiths, to R.A.F. Station, Dishforth, 3.12.36. C. W. S. Jones, to R.A.F. Station, Andover, 2.12.36.

Commissioned Engineer Officer

Flying Officer.—S. W. Blight, to R.A.F. Station, Wyton, on appointment to a permanent commission, on probation, 18.11.36.

Medical Branch

Wing Commander.—W. E. Barnes, to R.A.F. General Hospital, Hinaidi, Iraq; for duty as Medical Officer, 17.11.36.

Squadron Leaders.—G. J. Hanly, to Home Aircraft Depot, Henlow; for duty as Medical Officer, 28.11.36. L. Freeman, to No. 203 (F.B.) Squadron, Basrah; for duty as Senior Medical Officer, Bastah, 17.11.36.

Flight Lieutenants.—E. Donovan, to No. 101 (B) Squadron, Bicester, 28.11.36. J. McGovern, to R.A.F. Station, Hucknall, 28.11.36. W. P. Stamm, to Princess Mary's R.A.F. Hospital, Halton, 28.11.36. F. W. P. Dixon, M.B.E., and T. C. Macdonald, to Superintendent of the Reserve, Hendon, 28.11.36. J. Kemp, to R.A.F. General Hospital, Palestine, and Transjordan, Sarafand, 1.10.36. H. L. Willcox, to Aircraft Depot, Hinaidi, Iraq, 12.10.36.

Flying Officer.—W. J. Fowler, to R.A.F. Station, Wyton, 2.12.36.

COMMERCIAL AVIATION

— AIRLINES — AIRPORTS —

THE WEEK AT CROYDON

The Week's Disaster and a Controversial Letter : American Comings and Goings

LAST week at Croydon was a gloomy enough one in all conscience, and in more than one sense—the national crisis, virtually constant QBI, and the K.L.M. tragedy.

Perhaps, before commenting on these and less serious subjects, it is appropriate that I should disillusion my readers; this is *not* the familiar cynical *critique* of "A. Viator" that you read, but the garbled jottings of "T. A. R. Mac," who has been known to deputise for the Croydon maestro in the past, and who now once again steps into a breach, this time caused by "A. Viator's" unavoidable absence (absences are always unavoidable) on business.

Of the national crisis much has been written and overmuch said, but so far as Croydon is—or was—concerned, the week's upheaval has emphasised to our many friends among foreign pilots that we English are a strange people!

Despite the QBI conditions, Wednesday of last week might have been recorded very much as a normal day's work had it not been marred by the tragic accident to the K.L.M. Douglas piloted by Commander Hautzmayer.

Normal Procedure

It is not for us at Croydon to opine as to the cause of this disaster, though our sympathy is extended to K.L.M. and those bereaved by the accident, but it would appear to be generally felt that, with such an experienced pilot and the extreme caution characteristic of the company, something of an extremely unusual nature must have been the *raison d'être* for this fatality. It is all the more lamentable, therefore, to find individuals unfamiliar with the routine procedure of QBI control and the ensuing "white-line" take-offs, rushing into print before first acquainting themselves with the safety or otherwise of the regulations promulgated after the careful deliberations of men experienced in safe air travel under adverse weather conditions. It is surprising to the denizens of this airport that Lt.-Col. Moore-Brabazon, M.P., who was once an aviator of some repute, should have subscribed himself to a letter so lacking in accuracy as that published in Monday's *Morning Post*. He says ". . . it will surprise the air-travelling public to learn that over one of the most important points—namely, whether conditions are such as to permit flying at all, such as occur in fog—no Government control exists.

"I am aware that this was a foreign machine, and therefore rules governing it are difficult, but the idea that one may fly in conditions involving risks and get through *with the advertisement accruing therefrom, while another line of aircraft more prudent stays on the ground*, introduces a competitive spirit in danger to the public of a mischievous type, which must result in general harm to *all* operating companies." (The italics are mine.)

In short, Lt.-Col. Moore-Brabazon would have the control officers at state-controlled aerodromes, and possibly all leading aerodromes, armed with the necessary authority to ban all flying operations under fog or other conditions detrimental to the safe departure of aircraft.

This question has been the subject of much deliberation in the past, and the fact that no decision one way or the other has so far been reached is in itself an indication that opinion is—and is apparently likely to remain—divided for some time, alike among the Powers-that-Be, pilots and operating companies.

In the face of Wednesday's weather conditions and the operations carried out before *and after* the K.L.M. calamity, one is prompted to question not only whether the power to ban flying operations is indeed necessary, but where the "advertisement" or "competitive spirit" referred to by Lt.-Col. Moore-Brabazon bears on the subject, while we at Croydon are still diligently searching for that "prudent company."

In these circumstances, and remembering that the visibility on Wednesday morning was fluctuating upwards and downwards of 50 metres, it is of more than passing interest to find that between 7.30 a.m. and lunch-time, *nine "white-line" departures* were booked out from Croydon as follows: Sabena, Air France Luft-Hansa and Swissair one each; Imperial Airways, two; and K.L.M. three, including that of Hautzmayer. Furthermore, the Swissair departure was made in the same type of machine and in a normal and routine manner only twenty-five minutes ahead of the unfortunate K.L.M. aircraft, while the 12.30 midday Imperial's service—the next out—was made without trouble in even lower visibility.

It is not, perhaps, so widely appreciated as it should be, that even *after* the white line finishes, there is still sufficient landing space for an aircraft to put down or slow up safely should the pilot be suddenly confronted with circumstances which warrant his making such a lightning decision; and I am told that there have been instances, either with a particular type of aircraft, or by a pilot in such abnormal conditions of visibility that the white line is momentarily lost, that a machine has throttled down, braked and returned or been led back to the beginning of the white line for a further attempt.

I have dealt with this rather controversial subject in some detail in an effort to establish—if that be needed—that the system used at Croydon for taking-off in limited conditions of visibility is, and has proved to be, practical in every way for experienced pilots in aircraft equipped for instrument flying and, of course, fitted with radio. To condemn its efficacy because its use has in one instance resulted in an accident is unfair to those who instituted it, use it and are successfully guided by it. As one operator put it, "It's akin to saying that because I drive down Purley Way in fog, and my left front wheel comes off and I go through the hedge, no cars should be allowed to use that road under those conditions!"

A cheering aspect of this accident was that, surrounded by flowers and sweets, Miss Bongertman, the plucky Dutch stewardess who survived the ordeal, went back to Holland on the 10 o'clock K.L.M. service on Saturday—her one desire being to resume her flying duties.

During the week, Olley's had charters to Paris and Bournemouth respectively, while Wrightways' daily Continental newspaper activities were supplemented by inland deliveries to Cardiff and Birmingham. Surrey Flying Services, Ltd., have been busy erecting Mr. C. E. Gardner's new Beechcraft and their own Porterfield, both of which arrived from America last week.

Talking of America, I hear that Captains Olley and Lynch-Blosse—respectively of Olley Air Service and British Airways—were last week seen aboard the *Queen Mary*, bound on a mission which is of considerable import to the organisations mentioned—and *should* be to those British constructors who deprecate such mundane "goings on"!

T. A. R. MAC.

Commercial Aviation

Far Eastern Terminus

DESPITE the remarks beneath the picture, reproduced in last week's issue, of the *Phillipine Clipper's* arrival at Hongkong it should be stated that passengers are carried by Imperial Airways on their Penang-Hongkong service. At the time we were not aware that they were carried other than by special arrangement.

The Airports Exhibition

THE annual conference of the Aerodrome Owners' Association, and the airports' exhibition in connection therewith will be held on January 20, 21 and 22, at the Central Hall, Westminster, London, S.W.1.

It is expected that two or three hundred municipal representatives and private aerodrome owners will be attending, so that the exhibition should be a useful one for all concerned. In the Central Hall there is space for seventy-five medium-sized stands, the fee for each of which is only £5, and the position of each exhibitor will be decided by ballot.

Lisbon Service Resumed

IN spite of the events in Spain which have necessitated the suspension of the services calling at Madrid, Air France have now been able to re-establish a passenger service to Lisbon on a once-a-week basis. This has been made possible by co-ordinating the ordinary daily Air France service between Toulouse and Casablanca with the weekly service operated by Aero-Portuguesa between Tangier and Lisbon.

The Toulouse-Casablanca line has been diverted from Tangier to Fez as a result of the civil war, so that passengers must cover the Fez-Tangier link by train—a seven-hour journey. There is also an arrangement for a rail link of eight hours from Casablanca to Tangier. The Tangier-Lisbon weekly service runs every Thursday, leaving at 8.30 a.m. and arriving at 11.30 a.m. The return journey from Lisbon to Tangier is operated on Saturdays, leaving at 1 p.m. and arriving at 4 p.m.

Subsidy Modifications

IN a recently published White Paper details were given of the temporary subsidy arrangements for the African mail service. The terms of the expiring agreement will be continued to cover the period between January 23 and April 1, when the Short boats, as reported in last week's issue, will be put on the Durban route. Previously, the subsidy arrangements had been modified when South African Airways took over the Johannesburg-Cape Town section of the route.

Under the proposed agreement Imperial Airways will continue to be paid at the existing rate of £113,000 a year. For the Khartoum-Lagos service the subsidy will be fixed at £250 for each single trip as soon as the service is fully open to passenger traffic; in the meantime the figure will be £400, with a relative deduction according to the number of passengers carried.

The Vellox Accident

IT may be remembered that on August 10 Imperial Airways' Vickers Vellox crashed three minutes after taking off from Croydon on a night flight to Paris, and the accident department of the Air Ministry has now—four months later—published the findings of the inspector.

The machine, carrying only its crew, their personal belongings and some sand ballast, took off normally, flew straight in a south-westerly direction until it was well outside the aerodrome boundary and had climbed to a height estimated by officials on duty in the control tower to be in the neighbourhood of 500ft., when it began to turn to the left—in the direction of the regular aerodrome circuit and towards its course for Paris. Shortly afterwards the turn was changed to one to the right, through about 180 deg., the machine losing height as it did so, and ultimately crashing among houses about a quarter of a mile outside the western boundary. An outbreak of fire occurred and the four occupants lost their lives. The machine was completely destroyed.

As a result of his investigation, the inspector of accidents came to the following conclusions.—(a) That the accident was due to a sudden loss of engine power occurring in circumstances that were unfavourable for—and may even have rendered impossible—the carrying out of a successful forced landing. (b) That the cause of the sudden loss of engine power cannot be determined, but that the evidence is suggestive of the starboard engine having been either the first or the only engine to fail, and that the most likely cause was either some obstruction of the fuel system or incorrect setting of the fuel controls. A new type of engine was, incidentally, being used.

Winter in Finland

FOR the first time since the company started operations some thirteen years ago, Areo O/Y, Finland, expect to run a daily service between Stockholm, Abo, Helsingfors and Tallinn throughout next winter, when there will be aerodromes at all these points. So we may also expect to see outside operators extending their lines to Finland.

Incidentally, Aero O/Y's first internal airline, using the recently acquired D.H. Dragon Rapide, will link Helsingfors with the industrial centres of Tammerfors and Viborg. In due course the company hopes to run a service right up to the Arctic Sea, which has important tourist possibilities.

British Airways' Christmas

SINCE Christmas Day falls on a Friday, British Airways have decided to extend their normal week-end ticket arrangements to Paris so that passengers may leave on Thursday and return on Tuesday—a six-day return at the recently reduced week-end return fare of £5 12s. 6d. Trains will leave Victoria for Gatwick on Thursday at 9.28 a.m. and 12.28 p.m.

The Copenhagen and Malmo service will be run as usual on Christmas Day, though there will be no service on Boxing Day, and the Lille service is being suspended on both days. A special leaflet giving fuller details of the holiday arrangement can be obtained from Terminal House, Victoria, London, S.W.1.

Dublin's Airport

IT is now considered fairly certain that Dublin will have a civil airport in the near future. Officials of the Department of Industry and Commerce are at present in communication with the Dublin Corporation on the matter. At present machines use Baldonnel aerodrome, the headquarters of the Irish Free State Air Force, but the Government does not consider it desirable that a military centre should be used for civil purposes.

The Corporation, it is understood, is being asked if it would be willing to contribute £75,000 towards the initial cost of £150,000 and fifty per cent. of the annual charge (about £10,000). Collinstown, about eight miles from Dublin, is being spoken of as the probable site of the new airport. The site was used as an aerodrome during the War.

Transatlantic Navigation

SOME of the problems of long-distance air navigation were described by Mr. Francis Hughes, of Henry Hughes and Son, Ltd., in a lecture given before the British Horological Institute on December 9.

Although, he said, Britain has always, as a seafaring nation, held the premier position in the manufacture of general navigation instruments, her manufacturers had not, in flying instruments, had the same opportunities as those in the States. Aircraft, in any case, tended to develop more quickly than their navigational devices. The instrument board itself, he thought, was an interesting problem. Each instrument was of different value, and it was difficult to know how to arrange them to prevent eyestrain. Practical points could only be obtained from the people using the instruments.

The equipment of machines for Transatlantic services was now uppermost in the minds of the manufacturers. There were no radio stations in the ocean, and an error in navigational accuracy of 2 deg. would give an error of one mile in thirty, or twenty miles in six hundred. Since such long-distance flights would probably be made above the clouds, celestial navigation might be used more, though with some loss of accuracy relative to marine practice. An aircraft sextant, weighing less than five pounds, he explained, carried its own horizon. There was considerable opportunity for the airman who became proficient as a navigator.

The "deck watch" had been modified for the air. Mr. Hughes showed a Longines wrist watch with a rotating bezel marked in seconds, which was easily set against a centre seconds-hand and enabled G.M.T to be read as well as on a chronometer. The time to the nearest minute was always known, and the rim was set correctly for seconds as soon as a time-signal started to come through.

The fact that the altimeter must be adjusted for different pressures was a disadvantage, and those who were enthusiastic over the marine echo-sounder must remember that air was not so satisfactory acoustically as water. In a ship the recording could be ultrasonic, but in the air it would have to be audible to avoid interference from engine noise. So far no echo sounder had been generally adopted for aircraft.

Burmese Days

AFTER carrying out operations on a comparatively small scale for a couple of years, Irrawaddy Flotilla and Airways now propose to extend their routes. A service has recently been opened between Mandalay, Rangoon and Yenangyaung, with intermediate stops, and another service will shortly be opened to include Tavoy. Previously, only seaplanes have been used, but aerodromes are now in course of preparation at various points.

The Flying Doctors

THE Commonwealth Government has agreed to grant a subsidy of £5,000 per annum towards the layout and upkeep of the Australian Aerial Medical Services' bases. The estimated annual expenditure on the four present bases—Cloncurry, Wyndham, Port Hedland, and Broken Hill—is about £14,000. Wyndham, incidentally, has recently been equipped with a radio station, which appears to be working very satisfactorily.

The Legal Side

The Law of Civil Aviation, by N. H. Moller, M.A., LL.M. (Cantab) (Sweet and Maxwell, Ltd., 2 & 3, Chancery Lane, London, W.C.2. 25s.).

TO collect all the information, analogous and otherwise, concerning the legal principles behind the operation of air transport, and to give a wide series of precedential law cases must be a difficult, not to say heartbreaking job. However, a standard work of reference in these lines has been badly needed for a long time, and will be an indispensable addition to the libraries of both airline operators and airport managers.

Mr. Moller, who has previously applied himself to the business of sorting out trade agreements, has done the job well in *The Law of Civil Aviation*, which is divided into two sections. The first of these is primarily concerned with the general trend of orders and regulations, while the second deals with the less thoroughly established principles. Ten appendices cover the actual details of the conventions, acts and regulations.

A few months ago we reviewed a somewhat similar book entitled *International Organisation in European Air Transport*. This, however, dealt with the historical and political aspect of the problems involved, and the two books do not clash in essential appeal or value.

Another Step

ON Saturday another move in the development of the new Empire mail plan was made when *Centaurus* left Hythe, Southampton, with mails for Alexandria. Capts. L. A. Egglesfield and E. S. Alcock were in command, and the machine is expected to reach its preliminary destination to-day. *Centaurus* will, of course, remain in the Mediterranean on the normal service from Brindisi.

Caledonia, the long-range boat, incidentally, should shortly be leaving Southampton on the first of a series of experimental flights—probably to India and back with the mails. The pilots will be Capts. W. N. Cummings and G. T. Powell.

The Croydon Disaster

BEYOND placing the tragedy on record, very little can at present be said about the causes of the accident to the K.L.M. Douglas D.C.2 at Croydon on December 9, when fourteen persons were killed. One of the survivors has since died, and among the victims were Admiral S. A. A. Lindman, twice Prime Minister of Sweden, and Senor Juan de la Cierva, an appreciation of whose life and work appears on page 654.

The Douglas, piloted by Commander Hautzmayer, left the control tower in 50-yard visibility at 10.30 a.m., after half an hour's delay, and started its take-off run down the white line, which lies approximately east to west. Apparently the machine left this line, possibly owing to a momentary difference in power output between the two engines, before it was airborne, and certainly turned to port long before a pilot would normally attempt to start turning on to course in such conditions. The swing may have been more pronounced than was imagined by the pilot, but the climb appeared to be normal, though towards rising ground on the south-west side of the airport. For this reason the machine touched a chimney on a house in Hillcrest Road and dived into another on the opposite side of the road. Fortunately, the house was empty, and both this and its semi-detached neighbour were burnt with the machine.

Lord Swinton sent the following message of sympathy to Dr. Colijn at the Hague: "Greatly distressed to hear of deplorable accident to K.L.M. aircraft at Croydon to-day. Please accept my sincere sympathies.—Swinton."

Comment appears on page 644 and in the Croydon Notes.

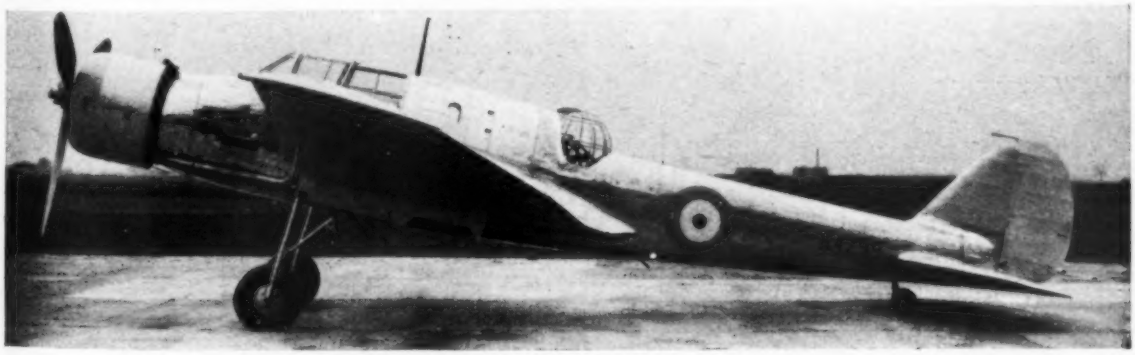
USING THE AIR ARM

"Air Power and Armies," by Wing-Commander J. C. Slessor, M.C. (Oxford University Press, 10s. 6d. net.)

IN these days when talk about air defence goes on all round, it is quite a change to come across a book which deals with the work of aircraft in a land campaign. This book is based on a series of lectures delivered at the Army Staff College at Camberley between 1931 and 1934, and it deals with questions far beyond the scope of the reconnaissance work of the so-called army co-operation squadrons.

The writer's strong point is not lucidity of style, and the book does not make easy reading. It is, however, so full of ideas that a careful perusal is well repaid. It should certainly be studied at the R.A.F. Staff College at Andover, and perhaps it is so studied. All higher ranks of the R.A.F. ought to be trained in the theories of aircraft as an arm of the Army, for Wing-Cdr. Slessor holds that "air contingents for any overseas expedition must be drawn from the Air Defences of Great Britain." At present, certainly, there is nowhere else to draw them from, but as the Metropolitan Air Force is being brought up by degrees to the strength considered necessary for Home Defence, it is certain that all sorts of objections would be raised to sending any portion of it overseas. That is a very weak point in our present organisation, and our air strength ought to be such that the despatch of an expeditionary air contingent with the Army would leave our Home defences undepleted.

Wing-Cdr. Slessor holds that there are three classes of objective at which an army's air arm can strike: (a) troops; (b) supply, and (c) production. The occasion for selecting each of those objectives should be carefully chosen. When a battle



APPROACH TO A PROBLEM—II: Built to Air Ministry specification P.27/32 this new Armstrong Whitworth monoplane has a Tiger VIII fourteen-cylinder radial with two-speed supercharger driving a D.H. variable-pitch airscrew. Another view appears on page 651. *(R.A.F. Official photograph.)*

is at a critical stage, the aircraft must concentrate on helping the troops in all possible ways. It may be necessary to use all the fighters for low-flying attacks. In this connection, he says that the air machine gun, though alarming, is a surprisingly innocuous weapon. This is not news to infantry officers, who well appreciate the difference between plunging fire and grazing fire. The light bomb should be the fighter's weapon against troops. At the same time the writer lays it down that "the aeroplane is not a battlefield weapon," and puts the words into italics. The best work which the aircraft can do during a battle is to isolate the battlefield, and to prevent the enemy from bringing up reinforcements and supplies. This should be done by concentrated bombing of carefully selected points on the lines of communications. He has much to say on the best way of paralysing the enemy's railways, laying it down that dislocation should be the object, not destruction. But the bombing must be concentrated and continuous, and be kept to the smallest possible number of important spots, which should be selected by the General's railway advisers. Various interesting points are made, such as that it is better to bomb an entraining railway station than a detraining one, except when matters are very critical on the battlefield.

During a battle no aircraft should be employed on any work not connected with the battle, with a few vital exceptions. As an example of misuse of aircraft, the writer mentions the case of the Independent Air Force attacking German production (i.e., the third and most remote objective) while the German Army was straining the British Fifth Army almost to the breaking point. At such a crisis every bomber which could be raised from everywhere ought to have been massed for the attack on the German reinforcements and immediate supply. That would have done more to stop the enemy's advance than was done, or could be done, by the self-sacrificing action of the low-flying fighters.

In the intervals between battles aircraft may be used for attack on the enemy's production. In the long run that may do more to win the war than any other form of air action, but its effects are slow. It will not win any particular battle, and it is obvious that there would be small satisfaction in making victory possible next year if one were to lose the war this year. The moral is that objectives must be selected with discrimination and with nice regard for the situation at the moment.

There are innumerable other lessons taught in this most instructive book, and it has only been possible to select a few of the more important ones for mention. This notice may be ended by quoting a sentence from the last chapter. Wing-Commander Slessor writes: "No attitude could be more vain or irritating in its effects than to claim that the next great war—if and when it comes—will be decided in the air, and in the air alone."

F. A. DEV. R.

AN INTERESTING FUEL PUMP

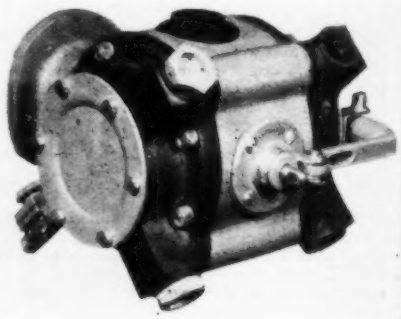
DESIGNED for use with modern high-powered aero engines, the latest fuel pump produced by the Korect Depth Gauge Co., Ltd., has some interesting features. Known as the Model KM4a, it is a compact self-contained unit of the double-diaphragm type, and is capable in its standard form of deliveries ranging from 1,050 to over 1,200 pints per hour, with lifts of between 3ft. and 10ft. against a delivery head of 6ft.; these figures can be increased in the case of models designed to meet special requirements.

The diaphragms, made up of layers of special fabric, are operated by an eccentric cam on the driving shaft. This cam draws each diaphragm inwards on the suction stroke through the medium of stirrups and cross-head plates, while the delivery stroke, effected by spiral compression springs, returns the diaphragms in the opposite direction. Suction and delivery disc-type valves simultaneously deal with the fuel in the appropriate manner.

When the carburetter closes down, the pressure built up in the delivery line overcomes the force exerted by the diaphragm return springs. The diaphragms are in consequence pressed inwards, but the design of the operating stirrups permits the driving cam to rotate "free." Also, if more fuel is delivered than is required by the engine, a small excess pressure arises on the working side of the diaphragms, and this prevents the springs from performing their full stroke. This arrangement provides automatic regulation of the fuel supply in accordance with engine requirements.

While the pump is self-priming, a hand primer is incorporated, and suitable connections are also arranged for the test cocks which, to comply with Air Ministry requirements, form part of the installation.

It is stated that the pump absorbs only a very small amount of power and that it will function without attention over long periods; the working parts run in grease, one supply of which is sufficient for 400-500 flying hours. The weight of the standard KM4a pump in service condition is approximately 4½ lb.



This photograph shows the compact design of the Korect Depth Gauge Company's fuel pump.

Full details of the pump, together with data regarding the pressure regulating valve—an independent unit which, however, is an essential part of the installation—are obtainable from the manufacturers, the Korect Depth Gauge Co., Ltd., Parliament Mansions, Victoria Street, London, S.W.1.

AERONAUTICAL PATENT SPECIFICATIONS

(The numbers in brackets are those under which the Specifications will be printed and abridged etc.)

Published December 3, 1936.

10418. ELLOR, J. E.: Radiator cowling for aircraft (456,335).
13229. HELLER, M., and TIPPELT, A.: Undercarriages for aeroplanes (456,139).
13283. COLLAR, A. R.: Motion-transmitting mechanisms particularly for use the actuation of control surfaces of aeroplanes (456,144).
19602. JONES, T.: Aircraft provided with rotating wings (456,177).
20634. SPERRY GYROSCOPE CO., INC.: Aircraft locating systems (456,078)
21558. HEINKEL, E.; Evaporative cooling systems for engines and other machines, especially for aircraft engines (456,385).
16332. CLIFFORD, E., and AIRSCREW CO. LTD.: Airscrews (456,126).
17858. AIR PUBLICITY, LTD., and MACLEOD, L. S.: Aerial posters (456,076).

(Published December 17, 1936.)

4321. ATKINS, H. C.: Methods of landing aircraft in fog (456,838).
7914. PERCIVAL, E. W.: Aircraft, particularly aeroplanes (456,969).
11884. BENDIX AVIATION CORPORATION: Shock-absorbers (456,897).
12074. SIEMENS APPARATE UND MASCHINEN GES.: Regulating arrangement for the propelling gear of an aircraft having a variable-pitch airscrew (456,975).
14575. WHITTLE, F.: Propulsion of aircraft (456,980).
14714. BENDIX AVIATION CORPORATION: Gear-shifting mechanism (457,108).
14786. IRVING, H. B.: Brake or landing flaps and other control surfaces for aeroplanes (457,114).
15772. FAIREY, C. R.: Means for extinguishing fires on aircraft (456,910).
27304. BENDIX AVIATION CORPORATION: Change-speed mechanism (457,068).
32199. BLICHARSKI, F.: Propelling devices for watercraft and aircraft (457,079).
3022. SOC. D'INVENTIONS AERONAUTIQUES ET MECANIQUES S.I.A.M.: Device for the automatic control of camber flaps and the like for aircraft (456,863).
10752. RHEINMETALL-BORSIG AKT.-GES.: Bombing mechanism for aircraft (456,959).
29067. BENDIX AVIATION CORPORATION: Gear-shifting mechanism (457,179).

NEW COMPANIES

In the notes below, for reasons of space, the "objects" of new companies are usually somewhat abbreviated.

NORTHERN SCHOOL OF AVIATION, LTD.—Private company, registered December 2. Capital, £5,000 in 5,000 ordinary shares of £1 each. Objects: To organise and control training schools for teaching flying, aeronautical and general engineering and navigation, etc. The subscribers are: Walter R. Chown, 28, Ollerbarrow Road, Hale, Cheshire, company director; Edward B. Goldwin, Westside, Clifton Avenue, West Hartlepool, company secretary. The first directors are to be appointed by the subscribers.

ELLIOT EQUIPMENT AND ACCESSORIES, LTD.—Private company, registered December 9. Capital £5,000 in 5,000 shares of £1 each. Objects: to adopt an agreement with D. Ll. Lloyd Jones and Stanley K. Davis for the acquisition of certain stock, machinery and plant lately belonging to the British Russell Parachute Co. Ltd., and to carry on the business of manufacturers of and dealers in canvas, hessians, linen, cotton, wool, balata, cloth, sales, webs, cables, ropes, makers of tents, marquees, parachutes and balloons, etc. The first directors are Stanley K. Davis (chairman and managing director) and David Ll. Lloyd Jones. Registered Office: 77, Collingdon Rd., Cardiff.